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Currency mismatch and the sub-prime crisis: firm-level stylised facts from Hungary*

(Fedezetlen devizaadósság és a válság: stilizált tények magyar vállalati adatok alapján)

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Contents

Abstract

This paper investigates currency mismatch in the Hungarian corporate sector. Using a novel dataset on non-financial firms we first identify firms with mismatch, measure their weight in the economy and show their main characteristics. We then analyze the performance of firms during the crisis. We find that a significant share of firms with FX debt had no natural hedge, i.e. no FX revenues from exports. The firms exposed to currency mismatch had a sizeable share both in real aggregates and on the loan market before the crisis. Firms with currency mismatch tended to be larger and more indebted, which suggests that FX borrowing might have eased their liquidity constraint before the crisis. During the crisis balance sheet effects were likely to be triggered by the large depreciations. Firms with FX loans had a larger fall in investment, and were more likely to go bankrupt. Their deteriorating performance and the reassessment of holding FX debt both by banks and firms led to major changes on the loan market. FX lending became less popular, and firms with mismatch were less likely to get new loans.

JEL: F31, F34, G32, L25.
Keywords: currency mismatch, liability dollarisation, firm level data.

Összefoglalás

A tanulmány a fedezetlen devizakitettségeket vizsgálja a magyar vállalati szektorban. Egy nem pénzügyi vállalatokra összeállított új mikroadatbázison először azonosítjuk a fedezetlen devizakitettséggel rendelkező vállalatokat. Majd elemezzük a gazdaságban betöltött súlyukat, megmutatjuk főbb jellemzőiket. Végül értékeljük a válság alatti teljesítményüket. Eredményeink szerint a devizahitellel rendelkező vállalatok jelentős részének nem volt természetes fedezete, vagyis exportbevétele. Súlyuk mind a makrogazdaságban, mind a hitelpiacon jelentős. A fedezetlen devizakitettséggel rendelkező vállalatokra jellemző, hogy nagyobbak és jobban eladósodottak, ami azt sejteti, hogy a devizahitelezés jelentősen enyhítette a válság előtt a likviditási korlátokat. A válság alatti nagy leértékelődések valószínűleg erőteljes mérleghatásokat okoztak. A devizahitellel rendelkező vállalatok beruházása nagyobb mértékben csökkent, és nagyobb valószínűséggel mentek csődbe. Romló teljesítményük, valamint a devizahitelezés — mind a bankok, mind a vállalatok általi — újraértékelése jelentős változásokat indított a hitelpiacon. Csökkent a devizahitelezés népszerűsége, és a fedezetlen deviza adósok kisebb valószínűséggel vettek fel új hitelt.

1 Introduction

Currency mismatch and the balance sheet effects triggered by sharp depreciations are at the heart of third-generation type currency crises.[1] These currency crises are often accompanied by banking crises and lead to deep recession. Typical examples were observed in Latin America and in East Asia in the 1990s and early 2000s, but also in Central-Eastern European countries, where currency mismatch reached unprecedented levels before the recent sub-prime crisis. Among the CEE countries, Hungary can be considered as one of the most affected by currency mismatch.[2] The assessment of mismatch is not quite straightforward by simply looking at aggregate data. In Hungary, foreign currency (henceforth, FX) lending made up about 60% of GDP before the crisis. This is comparable to figures observed in other emerging countries which have suffered from third-generation type currency crises. FX loans to the household sector (25% of GDP) evidently contributed to mismatch as households hardly have any income in foreign currency. To judge currency mismatch in the corporate sector, FX lending is often related to exports, which was about 30% in Hungary before the crisis. This is not high in international comparison. However, we know that FX lending was common even in the non-tradable sectors. Moreover, evidence from an earlier survey also confirmed that firms without natural hedge took on FX loans extensively (Bodnár, 2009). The large depreciation of HUF during the crisis rendered it necessary to have a more reliable picture on currency mismatch at the corporate sector by using micro data.

Currency mismatch arises for firms when the currency denomination of their assets and liabilities or revenues and expenditures differ. This exposes them to the effect of exchange rate changes. In a general sense, even exporters have currency mismatch in their balance sheet. However, the most studied case is when firms have a short FX position due to liability dollarisation.[3] Since liability dollarisation leaves countries vulnerable to multiple financial crisis (to currency, banking or even to sovereign debt crisis). A rich and growing literature on liability dollarisation[4] points to several factors, which contribute to the inability or unwillingness of countries or firms to take on domestic currency debt. Original sin, a bad inflation history, macroeconomic policy credibility, explicit and implicit guarantees to bail out banks or firms, or even the potential adoption of the euro could play a role.

Given liability dollarisation, a significant depreciation of the exchange rate triggers balance sheet effects. As the debt burden of foreign currency indebted firms rises, their net worth declines. In turn, changes in the balance sheet affect the creditworthiness of the borrower, and banks adjust lending standards and the price of loans accordingly. As a result, investment falls. In addition, firms' defaults may contaminate banks, resulting in a further decline in access to loans or an increase in the price of loans. These balance sheet effects can partially or fully offset the impact of improving competitiveness caused by depreciation. Therefore, currency mismatch alters the exchange rate channel, which is the most important monetary transmission channel in a small open economy such as Hungary. An expansionary monetary policy will weaken the exchange rate, but will not necessarily stimulate the economy exposed to the mismatch. Thus,

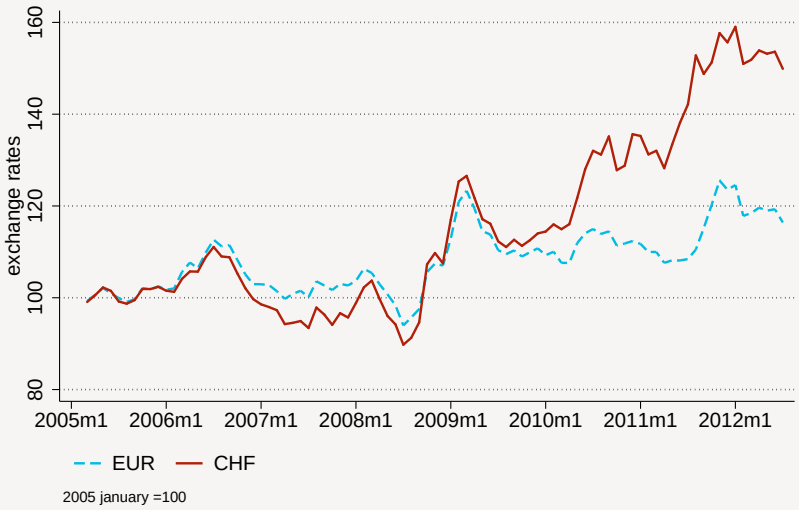
[1] Eichengreen et al. (2003), Krugman (1999), Christiano et al. (2004).

[2] Although in the Baltic countries lending in foreign currency was more prevalent, because of the currency board no depreciation occurred and balance sheet effects were not triggered.

[3] Throughout the paper dollarisation will be used to describe indebtedness in any foreign currency not just the dollar. In Hungary, the two main foreign currencies are EUR and CHF.

[4] For review see Goldstein & Turner (2004), Zettelmeyer et al. (2010), Ize & Yeyati (2005).

Figure 1
Exchange rates of HUF against CHF and EUR



currency mismatch results not only in financial stability concerns and threats with sudden stop type deep recessions, but also undermines the ability of monetary policy to act counter-cyclically.

The aim of this paper is to analyse currency mismatch in the Hungarian corporate sector. A newly compiled dataset which contains the balance sheet, debt composition, export revenues and import expenditures of firms allows us examine currency mismatch at the firm level. The novelty of this dataset is its almost full coverage both in terms of firms and FX exposures. We document the degree and macroeconomic importance of currency mismatch and examine whether foreign currency debt affected the behaviour of firms during the crisis. We look at firms' performance, their probability of bankruptcy and changes on the loan market. Simple descriptive statistics are used to underline the main findings throughout the paper. We aim at documenting stylised facts, and generally talk about co-movements rather than causality, although in some cases evidence is found for the latter as well.

Firm-level investigations concerning the effect of currency depreciation via foreign currency debt reveal the importance of firm heterogeneity. Studies agree on the immediate negative effects of depreciation on firms' balance sheet. However, there is still considerable debate on the extent of the adverse effect on employment or investment, on the net of the balance sheet and competitiveness effects and on the appropriate policy implications.

A pioneering study on the subject (Bleakley & Cowan, 2008) looks at listed firms of five Latin American countries, where in many countries the perceived security of the exchange rate peg encouraged liability dollarisation. They find that firms holding more dollar debt do not invest less than their peso-indebted counterparts following a depreciation, as firms match the currency denomination with the exchange rate sensitivity of their profits.

However, several results contradict the findings of Bleakley & Cowan (2008). In summarising the micro-level evidence, Galindo et al. (2003) note that firms are only partially able to match their liabilities, and the investigated firms may not

represent well the economy. Using 1990s data from Brazil, they find that firms more indebted in foreign currency tend to invest less when there is exchange rate devaluation. Negative effects are found by several other authors as well.[5]

Although firm-level data are gradually becoming more available, information on loans remains scarce. Most studies use information on stock market listed firms only. Listed firms are the largest and most productive firms of the economy. If exporters are over-represented in such samples, the overall balance sheet effect can be underestimated, as competitiveness effects will dominate. Studies also vary in terms of how precisely they capture the FX exposure, which could appear in assets, liabilities and income, or in off-the-balance sheet derivative positions. Most of the studies are only able to use partial information. Exceptions are Janot et al. (2008) and Cowan et al. (2005), who collected information even on firms' derivative positions. The latter shows that balance sheet effects are more significant when mismatch is defined net of derivatives.

Evidence on Eastern Europe is limited and mainly focuses on pre-crisis years see Ranciere et al. (2010) and Brown et al. (2011). These authors argue that firm characteristics are key in explaining the choice regarding loans' denomination and find that mismatch eased credit constraints for small firms.

For Hungary, Bodnár (2006, 2009) analysed survey data to examine currency mismatch in the corporate sector. According to her results, more than half of firms have some foreign currency debt without any export revenue. This phenomenon is more pronounced in the case of smaller firms which were mainly motivated by the lower interest rates on FX loans. Moreover, depreciation decreases the profit according to both the subjective answers of the CEOs and the analysis of cash flows and balance sheets. Additional results are provided by Endrész & Krekó (2010), who used sector-level data to measure the extent of mismatch and to show that FX loans are used extensively in non-exporting industries as well.

Our study, using a comprehensive dataset, finds that firms with mismatch accounted for a sizable share of the economy before the crisis. During the crisis, firms with mismatch and in general firms with FX loans were hit harder and consequently had to adjust more than their peers. Their ability to generate profits and to survive declined more strongly. In line with their relatively worse balance sheet and default probabilities, their creditworthiness was likely to be reassessed by banks. There was a general decline in the probability of getting new loans, but the most affected groups were those with mismatch problems. Worsening balance sheet and deteriorating access to the loan market contributed to the decline in investment rate, and again the hardest hit group was that of firms with mismatch.

The structure of the paper is the following. In section 2 we briefly introduce the dataset, with more details provided in the Appendix. Then, in section 3 mismatched firms and exposures are identified, and their aggregate importance and characteristics are investigated. Next, in section 4 we investigate what happened during the crisis. In order to detect the presence of balance sheet effects, the heterogeneity of firms' behaviour during the crisis is examined. If differences in performance and loan decisions are detected among firms with mismatch and their peers, that is taken as suggestive evidence of balance sheet effects. In addition to reporting stylised facts, balance sheet effects are formally tested as well. We also exploit the fact that an entirely novel dataset has become available and we document some interesting findings on loan behaviour for example, and on the characteristics of specific groups of firms. Finally, section 5 presents the conclusions.

[5] See Janot et al. (2008) and Bonomo et al. (2003) for Brazil, Aguiar (2005) for Mexico and Galindo et al. (2007), Cowan et al. (2005) for Chile. Mixed or moderate effects are found for a group of Asian counties by Allayannis et al. (2003) and for South Korea by Gilchrist & Sim (2007).

2 Data

Several firm-level databases were combined for the analysis. The first one is the APEH database, which contains the annual financial reports of Hungarian firms using double-entry bookkeeping for the period between 2004-2010. Our second source is the Hungarian Central Statistical Office's TRADE database which contains monthly export revenues and import expenditures of firms for the 2004-2010 period. In 2004, the within the EU export and import became self-reported above a certain transaction size, and hence smaller firms' flows may be omitted. The third database, the credit register (for short CR) contains all corporate loan contracts with Hungarian financial institutions from 2005. Balance of Payments (BoP) contains information on loan contracts between Hungarian firms and non-residents from 2008. Additionally, we used bankruptcy data from OPTEN, a private data vendor, which consists of official announcements on liquidation and bankruptcy procedures.[6] A detailed description of these datasets is provided in the Appendix A. Hungarian firms rely extensively on external funding. Part of those funds come from mother companies, which is ignored in this analysis as those stocks rather reflect group-level funding and liquidity management and their maturity is uncertain. For both the CR and the BoP, loan stocks are expressed in HUF. Information on FX derivative positions would be also needed to correctly measure FX exposure. Unfortunately in Hungary no firm-level breakdown is available on FX derivatives. However, such positions are suspected to be held by large, exporting or foreign-owned companies. Therefore, they are not likely to distort our analysis. For our analysis we constructed two datasets. The first one combines APEH, TRADE, CR and BoP. In merging these datasets we used APEH as the starting point. APEH gives almost full coverage of the Hungarian corporate sector, which is a great strength of our database. As APEH is of annual frequency, we use the yearly flows of exports and imports and the end-of-year loan stocks. In the case of firms that are not contained in TRADE, CR or BoP, the variables stemming from the respective database are set to zero. The second dataset, based on OPTEN, is used for the bankruptcy analysis only. It is constructed in the following way. For each bankruptcy observation in OPTEN we map the firm characteristics from the last available observation of the firm in the previously described dataset (that combines APEH, TRADE, CR, and BoP). Often, many years elapse between the last financial report of the company and the announcement of bankruptcy. To address this problem instead of examining bankruptcy frequencies we calculate probability of bankruptcy within 1 but also within 2 years. Even this way almost half of the announcements are ignored.[7]

Some observations from TRADE, CR and BoP are not included in our sample. Table 1 documents the weight of the excluded firms by database for 2007.[8] Some are dropped because we do not find corresponding APEH observations, while others are dropped because we ignore certain type of firms in the analysis, namely special purpose entities, public companies and the financial sector.

Our final sample contains 89 percent of firms involved in foreign trade. Firms not in APEH represent 9 percent of all traders, while excluded firms make up 2 percent of trading firms. In terms of volume, our sample's coverage is 84 and 88 percent.

[6] Less than half of all bankruptcy events are used in the analysis. The coverage is small, because the Opten dataset contains not just firms using double-entry bookkeeping but also self employers amongst others.

[7] As a robustness check another dataset is used as well, where yearly bankruptcy frequencies are used. A bankruptcy event is taken into account if the company information is not older than 3 years ▫ that is the time between bankruptcy and the last APEH report is 3 years at most. This way about 2/3 of OPTEN events are used. The shortcoming of this approach is that recent data of surviving firms and rather old information on bankrupt firms are compared. Nevertheless the results are robust to changes in the dataset.

[8] Similar results are obtained for the other years.

Table 1
Share of the sample relative to the total for the year 2007

		our sample		not in APEH		omitted**	
APEH	# obs.	355,467	97%			11,789	3%
	employment	2,128,884	87%			313,188	13%
	VA*	11,400	77%			3,350	23%
Trade	# obs.	19,895	89%	1,926	9%	446	2%
	export*	17,700	84%	3,130	15%	320	2%
	import*	18,500	88%	2,320	11%	320	2%
CR	# obs.	84,340	76%	24,601	22%	2,238	2%
	HUF debt*	3,430	71%	855	18%	525	11%
	FX debt*	4,140	86%	338	7%	310	6%
BoP	# obs.	1,377	70%	72	4%	525	27%
	HUF debt*	60	86%	2	3%	7.6	11%
	FX debt*	2,190	78%	99	4%	526	19%

* in thousand billion HUFs

** state and municipality owned firms, special purpose entities and financial firms

The coverage of our sample is significantly smaller for domestic loans (CR). The reason for this is that many firms which do not use double-entry bookkeeping have loans. These firms have smaller-than-average loans and the share of FX loans is below the average. In the case of BoP, special purpose entities explain the large share of excluded firms.

3 Firms with currency mismatch

For a firm, currency mismatch (for a short mismatch) arises when the currency composition of assets and liabilities or revenues and expenditures differ. Here, we are interested in short FX positions, which can play a critical role in the development and severity of balance sheet-type currency crises. A firm has a short FX position when its net foreign currency denominated liabilities exceed the present value of its net foreign currency denominated cash flows. If the domestic currency depreciates, firms with currency mismatch will experience adverse balance sheet effects as the net foreign currency denominated liabilities rise relative to net foreign currency denominated cash flow.[9]

We define mismatch by a simple categorical classification.[10] To identify firms with mismatch, we group them along two dimensions. The first dimension is related to the external financing of the firm. We distinguish three groups: firms without any loans, firms with only HUF denominated loans and firms that have loans in foreign currency. The second dimension is based on the involvement in international trade. The first group is that of net exporters, the second group consists of firms with imports exceeding exports in a given year. Firms that do not trade at all comprise the third group. Along these two dimensions, nine groups can be formed as illustrated by Table 2. In the Table, we use asterisks to mark the groups where currency mismatch is of prime interest: FX debt holders with net imports or without any trade.

Table 2
Defining firm with mismatch

	FX	HUF	no debt
net exporter			
net importer	⋆		
no trade	⋆		

This categorisation is also useful when one would like to compare the relative performances of firms and needs to find the relevant control group. Comparing firms with mismatch with the rest of the firms would be misleading as firms are very different both in terms of the trade dimension and the loan dimension.[11] The opposing dynamics of internal and external demand during the period under review also makes it necessary to take into account the trade status.

Thus we compare the two groups with mismatch to different control groups. Net importers with FX loans may be more similar in many respects to other trading firms than to those that do not trade at all. At the same time, if we would like to investigate whether firms with FX loan are different than non-trading firms, a comparison should be made within the non-trading group. Separation of the two mismatch groups may also be justified (above and beyond their different trade status) by the fact that depreciation affects net importers via both declining competitiveness and a deteriorating balance sheet.

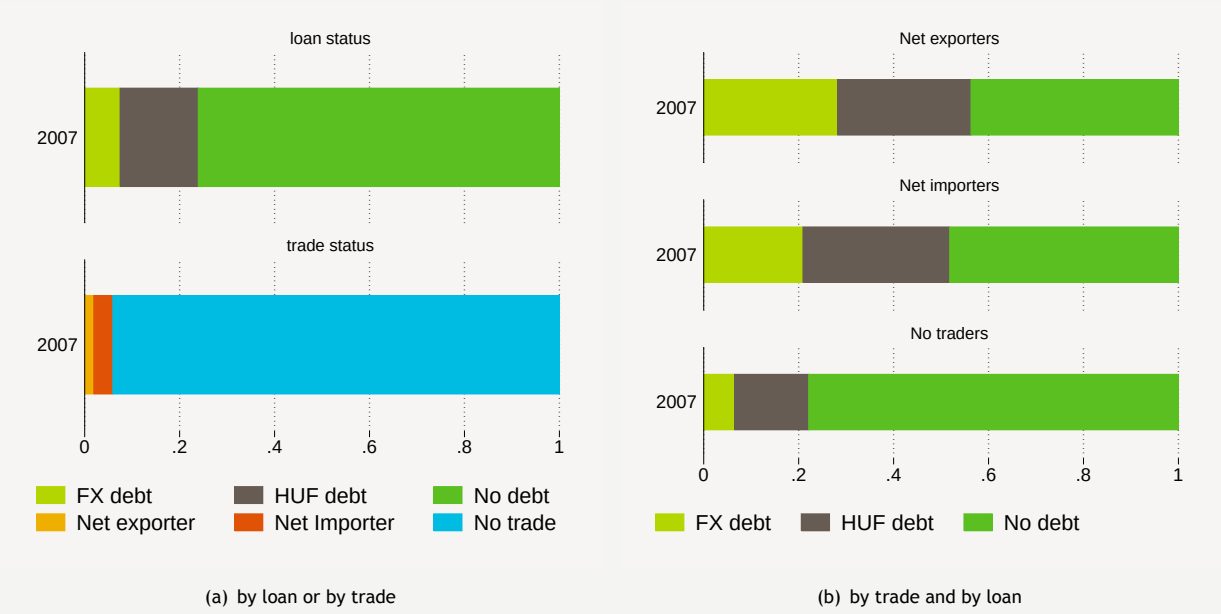
[9] See e.g. Eichengreen et al. (2003).

[10] An exact and continuous measure of mismatch is possible, but it goes beyond the stylised facts comprising the scope of this paper. We shall leave that as a topic of future research.

[11] See Bernard et al. (2007) for US firms, Mayer & Ottaviano (2008) for European firms, Békés et al. (2011) for Hungarian firms on the former issue.

Moreover, balance sheet effects can be meaningfully investigated even within the group of exporting firms. For exporters with FX loans, the beneficial effect of depreciation on competitiveness may be offset by the balance sheet effects. All in all, using nine groups is necessary to find the appropriate peer groups for investigating firms with balance sheet issues. We stick to this grouping of firms throughout the entire paper.

Figure 2
Composition by loan and trade status in 2007



(a) by loan or by trade

(b) by trade and by loan

The left panel shows the composition by loan and trade status in 2007. The right panel shows the distribution of firms by loan status for each trade category.

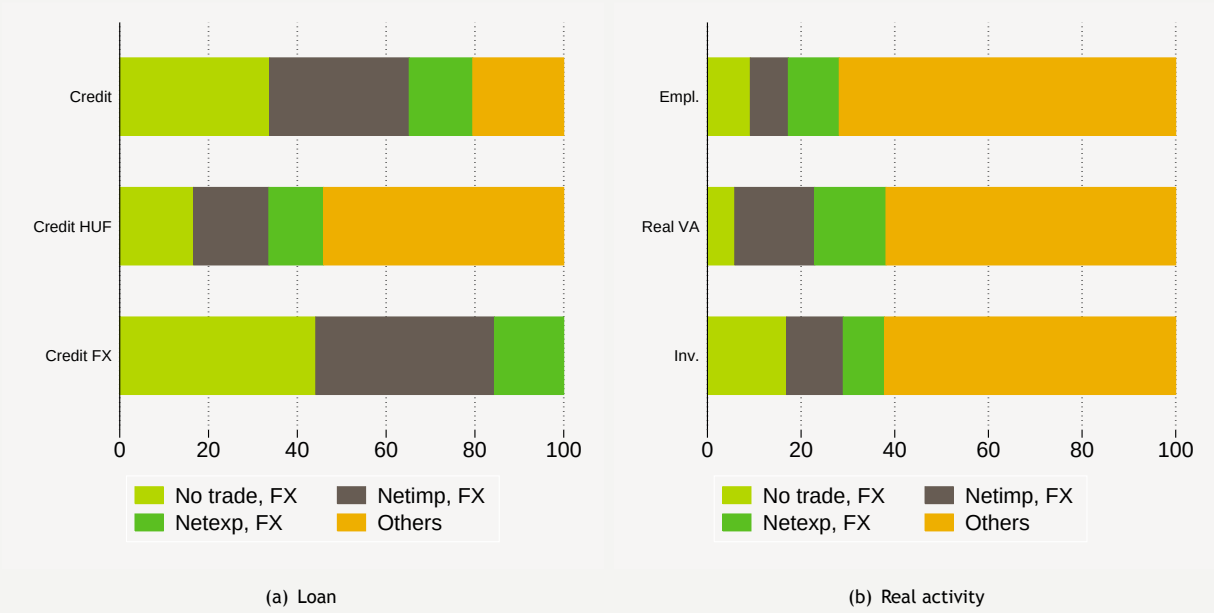
The distribution of firms across these groups is, of course, rather uneven. Firstly, most of the firms, about 76 percent, do not have any loans. See Panel A in Figure 2. About two-thirds of those which do have loans are indebted only in HUF, while others have FX debts as well. Secondly, foreign trading activity is rather rare. In 2007, only 6 percent of firms conducted any trade, and most of them (about 2/3) were net importers. Firms with exports or imports are more likely to be indebted. FX debt is more likely as well. In panel B of Figure 2 we look at the prevalence of loans within trade groups. Net exporters exhibit the highest share of firms with loans. Within this group, HUF and FX loan firms account for about the same share. In respect of net importers, a smaller share of firms is indebted, at about 50 percent. In addition, the share of FX loan holders is also smaller, amounting to 40 percent of all firms with loans. In the case of non-traders, only 22 percent of firms have any loans and less than a third of them have foreign currency loans. The majority of FX-indebted firms are subject to mismatch. About 82 percent of the firms with FX debt are non-traders. They constitute 6 percent of all firms. The other mismatch group, those with net imports and FX debt, represent approximately 1 percent of all firms and about 14 percent of trading firms. For further details, see Table 9 in the Appendix.

3.1 IMPORTANCE OF FIRMS WITH MISMATCH IN THE ECONOMY IN 2007

This subsection discusses the relative importance of firms with mismatch in the Hungarian economy. As we saw above, only 7 percent of all firms have mismatch problems, but this does not necessarily reflect their macroeconomic significance. Therefore, we look at their share in 2007 in the aggregate loan stock, employment, real value added and real investment; see Figure 3.

The two mismatch groups held 65 percent of all outstanding debt. About half of that was accounted for by net importers while the other half by non-traders. Their share is even more substantial when we look at FX loans only. Over 80 percent of foreign currency debt belongs to mismatch firms. As for the other groups, we find FX-indebted net exporters to have the third largest stake, at 16 percent.

Figure 3
Share of firms with mismatch in main aggregates in 2007



(a) Loan (b) Real activity

The left panel shows the distribution of all, HUF and FX loan aggregates by trade-loan status. FX debtors are divided by trade status, others are displayed together. The right panel shows the composition of aggregate employment, real value added, real investment. All data are for 2007.

Firms with mismatch have the smallest share in employment. In 2007, they employed only 17 percent of the workforce, non-traders and net importers having an equal share. In terms of value added, they constitute a higher share than in employment: in 2007 their share was 23 percent. Two thirds of this value added was produced by net importers. Looking at real investment reveals that in 2007 mismatch firms were responsible for 29 percent of corporate investment.

Overall, firms with mismatch have a significant share in the production aggregates. In addition, we find that firms with mismatch held almost 2/3 of the debt of the corporate sector, and a similar share is found when only domestic bank loans are considered. This implies that banks' balance sheet channel could be potentially strong. By making debt service more difficult, a depreciating exchange rate could affect the lender side as well, since books of the banks would also deteriorate. Depending on the strength of banks□ balance sheets, waves of defaults by firms with mismatch could lead to falling loan supply and tightening lending standards,[12] which in turn may result in deteriorating real activity. Therefore, the overall

impact of mismatched firms on the real economy could be much larger than is reflected by their weight in real output or investment.

3.2 CHARACTERISTICS OF FIRMS WITH MISMATCH

Firms used FX loans extensively in Hungary. Several factors may have contributed to this. Sizeable interest rate differentials prevailed before the crisis, while the exchange rate stayed close to the strong end of the intervention band and thus showed little volatility. This boosted demand for FX loans. Partly because of the increasing government debt, the country relied heavily on external funds. Together with original sin, resulted in dependence on FX funds. As banks are limited in taking large FX positions by regulation, liability dollarisation had to appear in other sectors. Finally, EU entry may have brought false security, with an expectation of quick EUR adoption and disciplined policy. This paper does not intend to test the significance of these factors. Nevertheless, it is worth looking at what kinds of firms took on FX loan. We find that FX indebtedness was a rather general phenomenon and led to significant indebtedness of firms.

Firms with mismatch are many sorts. To describe their characteristics, we use a simple regression approach. We run OLS regressions using dummy variables representing the nine groups of firms defined along trade and loan dimension. Additionally, sector and year dummies are included. This approach allows us to point out average differences across firm groups, comparing them within industries. Table 3 shows the regression results.

The first column of Table 3 presents differences in ownership.[13] The coefficients represent the average share of foreign-owned firms in the group indicated by the corresponding dummy variable. We find first that trading firms are more likely to be owned by foreigners.[14] Second, in each trade block the coefficient on HUF-indebted firms is the lowest. This implies that foreign-owned firms prefer either internal financing (no debt) or external financing in a foreign currency, but rely on HUF loans only much more rarely.

We also look at differences in firm size in terms of employment. Coefficients in this regression give the average firm size in a given group. First, we find that trading firms are larger. Second, depending on trade status, firms with loans are twice as large on average as firms without any debt. Furthermore, firms with foreign currency debt tend to be larger than those relying solely on HUF financing. As a result, firms with mismatch are larger on average than any peer within the same trading group. As both loan and trade status affect size, the two mismatch groups are very different. E.g. importers with currency mismatch are, on average, much larger than non-trading firms with FX debt. Further investigations of other characteristics reveal a similar ranking of firms along trade and financing characteristics. Firms either with loans or with foreign trade pay somewhat higher wages and are more productive. The differences found according to loan status suggests a selection mechanism across firms. That is, either only better firms apply for loans or only better companies are accepted by banks, or perhaps both. The sixth and seventh columns report the average indebtedness of the groups. First, we look at leverage which is defined by the ratio of loans to total assets. Results imply that regardless of their trade status, firms with foreign currency loans are more indebted on average. Before the crisis, a significant interest rate differential persisted in Hungary, while foreign exchange rates were rather stable. The lower rate on FX loans allowed for much larger leverage at a given debt burden. Next, we look at the share of foreign currency debt in total debt. This variable is defined only when firms have loans, and equals zero when the firm has a HUF loan only, but has a positive value if the firm has a FX

[12] Not just for firms with mismatch, but for companies in general.

[13] We define a firm to be foreign owned if at least 10 percent of its subscribed capital is owned by foreigners. Using 50 per cent threshold gives similar results.

[14] This finding is in line with the international trade literature, e.g. Mayer & Ottaviano (2008).

Table 3
Firm characteristics by trade and loan categories

		foreign own.	employment	avg. wage[A]	VA/capita[A]	TFP[B]	leverage	FX share in debt
Net exporters	FX debt	0.310***	114.4***	7.393***	8.119***	5.312***	0.213***	0.633***
		[0.00252]	[0.704]	[0.0118]	[0.0131]	[0.0122]	[0.00115]	[0.00207]
	HUF debt	0.172***	57.04***	7.296***	7.999***	5.172***	0.139***	
		[0.00240]	[0.671]	[0.0113]	[0.0126]	[0.0117]	[0.00109]	
	No debt	0.353***	38.45***	7.257***	7.964***	5.206***		
		[0.00198]	[0.569]	[0.00969]	[0.0110]	[0.0104]		
Net importers	FX debt	0.225***	63.73***	7.414***	8.250***	5.445***	0.206***	0.595***
		[0.00217]	[0.613]	[0.0103]	[0.0116]	[0.0108]	[0.000990]	[0.00187]
	HUF debt	0.174***	40.00***	7.353***	8.140***	5.336***	0.140***	
		[0.00178]	[0.507]	[0.00862]	[0.00977]	[0.00915]	[0.000811]	
	No debt	0.277***	18.21***	7.198***	7.940***	5.178***		
		[0.00151]	[0.443]	[0.00766]	[0.00886]	[0.00845]		
No traders	FX debt	0.0600***	10.97***	6.880***	7.649***	4.625***	0.303***	0.702***
		[0.00123]	[0.364]	[0.00637]	[0.00735]	[0.00697]	[0.000559]	[0.00135]
	HUF debt	0.0324***	9.087***	6.841***	7.480***	4.542***	0.230***	
		[0.00107]	[0.322]	[0.00568]	[0.00663]	[0.00632]	[0.000487]	
	No debt	0.0813***	4.303***	6.389***	6.853***	4.177***		
		[0.00101]	[0.310]	[0.00552]	[0.00646]	[0.00619]		

*** p<0.01, ** p<0.05, * p<0.1

A: values are in natural logarithms, B: We use Levinsohn and Petrin TFP estimation method (Levinsohn & Petrin 2003).

Each column represents coefficient estimates from a separate regression. The regressions do not include constant, but use year and sector level dummies.

loan. Therefore, only one coefficient is reported in each block. According to the estimates, non-traders have the highest FX debt share. Note that this is a comparison across FX debt holders, that is, it is conditional on having FX loan. Although non-trading firms are less likely to have a FX loan, once they have one, they are likely to have greater share of FX. Many non-trading firms have either just a HUF or just a FX loan. The reason for this could be that non-trading firms are mostly small and can afford to finance a small number of projects or have just one credit line, while trading firms are larger with many projects and many loans. This is confirmed by our data: in the case of FX-indebted firms, the average number of contracts is about three for traders and one for non-traders.

In sum, we found that firms with mismatch are somewhat larger and more indebted than their peers in the same trade group. Nevertheless, differences between firms are more pronounced along the trade and loan status. Firms with loans or with foreign trade are larger, more productive and traders are even more likely to be foreign owned. This also implies that the two mismatch groups are very different.

4 Changes brought by the crisis

The sub-prime crisis affected the Hungarian economy through various channels. In this paper, we are mainly interested in the balance sheet effects caused by the large-scale depreciation and the ensuing adjustments by firms and banks. During the crisis, the Hungarian forint depreciated significantly. Although HUF weakened against all major currencies, the extent of depreciation varied widely. CHF, the major currency of mismatch, appreciated by more than 50 percent by the end of 2010, while the strengthening of EUR, which mainly drives competitiveness effects, was less than half of that. The depreciation against CHF in itself triggered significant balance sheet impacts. In addition, the balance between the competitiveness and balance sheet effects was made worse by the widening gap between the CHF and EUR exchange rates versus the HUF. To investigate balance sheet effects, we look at the heterogeneity of firms' and banks' behaviour and performance. If the balance sheet matters, we expect firms with foreign currency denominated debt, and especially firms with mismatch, to be hit harder, show worse performance and adjust more. As part of this adjustment, we expect firms and banks to make efforts to get rid of their exposure to mismatch. On the loan market, adjustments were driven by both supply and demand factors. As to the demand side, firms were likely to reassess their financing structure. Thanks to the large interest rate differential, lending in FX before the crisis had eased the liquidity constraint of firms and may even have had a beneficial impact on growth (Ranciere et al., 2010). As UIP did not hold in this period, it was rational for firms to take out FX loans.[15] However, with the outbreak of the crisis it suddenly became a source of vulnerability. The increased volatility of the exchange rate was likely to make firms readjust their preferences regarding the level and currency composition of their leverage (Bleakley & Cowan, 2009). As to the supply side, banks had many reasons to alter the supply of loans, especially the supply of FX loans and loans to firms with currency mismatch. The first was the deteriorating balance sheet of firms, which lowered their creditworthiness. Firms with deteriorating balance sheets face tighter credit conditions; either the access and lending standards become stricter or the price rises. The second was the deteriorating balance sheet of banks, due to the credit losses suffered on loans to mismatched borrowers.[16] In addition, the crisis revealed the exposure of banks to grave FX funding risks. Their over-reliance on external FX sources and in particular on wholesale financing (which was reflected in their high loan-to-deposit ratio) raised severe financial stability concerns. At the outbreak of the crises, they faced serious FX liquidity shortages.

In sum, both demand and supply forces were probably at work on the loan market. We know that supply factors explain a part of the decline in lending during the crisis (see Sóvágó, 2011; Csajbók et al., 2010). Given our dataset, we can't separate the effects of the two, although we found some indirect evidence on the significance of the latter. As regards supply factors, we also cannot tell whether the primary driver was the deterioration of the balance sheet of banks or firms.[17] In this section, real and financial performance and bankruptcy probabilities are first compared between companies with FX loans/mismatch and their peers. Then we look at what changes occurred on the loan market. Finally using a standardised approach, we formally test whether there were significant differences in the performance of firms and their chances of

[15] See models developed for example by Bleakly and Cowan (2009). We estimated a model suggested by them, and found that the results are in line with their findings, e.g. the FX loan share correlates with firms' FX sensitivity of income and liquidity constraints, where liquidity constraint was proxied by size and foreign ownership.

[16] There are other channels as well, via which depreciation affect banks' balance sheet. Banks are subject to capital adequacy requirements. Because of the FX loans, depreciation directly lowers the capital adequacy ratio by raising the HUF value of its denominator, the risk weighted assets.

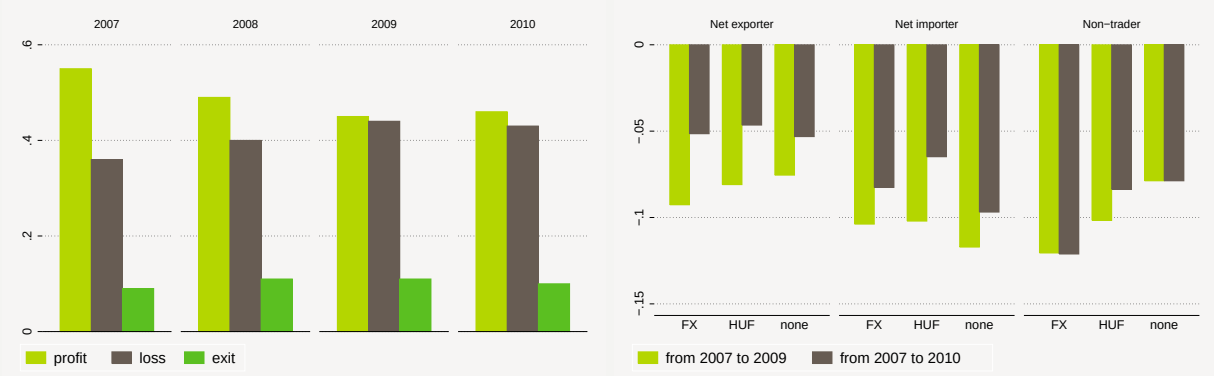
[17] To do that we would need bank level information. Unfortunately, in the CR we cannot identify the bank which provides the loan. Nevertheless, there is evidence from Senior Loan Officer surveys and from the paper of Sóvágó (2011) on the significance of banks' balance sheet.

obtaining new loans depending on their loan (and trade) status. We also examine whether balance sheet effects had just short-term or also longer-term consequences. We conclude by reporting how the weight of mismatch firms changed by 2010 as a result of the balance sheet effects and the corresponding adjustments made by firms and banks.

4.1 FIRMS' PERFORMANCE DURING THE CRISIS

As the crisis unfolded, the financial and real performance of firms deteriorated, and the number of bankruptcies climbed higher. The inferior performance of FX loan holders is detected both in their financial and real activity. Moreover, their survival probabilities declined more strongly relative to their peers.

Figure 4
Probabilities of making profit or loss



(a) Probabilities

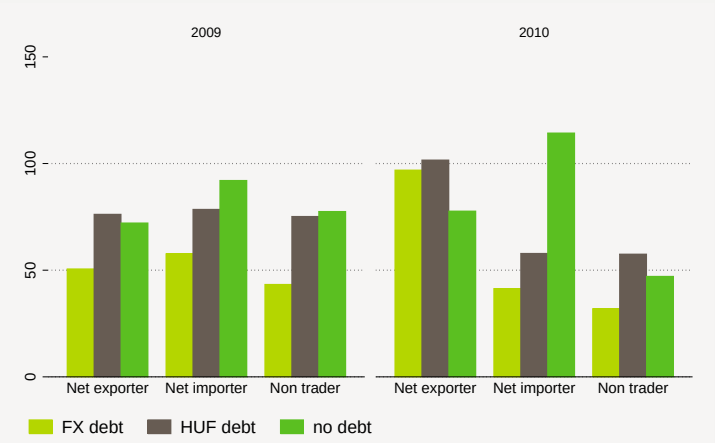
(b) Probability changes

Left panel shows the probability of making profit, loss or exiting in a given year. Right panel shows the changes over time in the probability of making profit the by trade loan group (of t-1).

As for financial performance, the ability of firms to generate a profit weakened. FX debt holders were hit not just by falling demand, but also by the depreciation of HUF, and therefore they are expected to show inferior performance. Figure 4 shows what share of existing firms in a given year was able to make profit, suffered a loss or exited in the next year. The share of profitable firms fell in both 2008 and 2009. At the same time, both the share of loss-makers and those who exited increased. In 2010, a slight recovery was seen, except in the no-trade group, which is explained by the persistently weak domestic demand. The comparison between trade-loan groups show that the decline was largest for firms which had FX loans.

During the crisis, investment plummeted in all trade-loan groups. This is documented by Figure 5, which shows the total investment of firms by trade and debt categories, taking 2008 as a base year. Investment activity dropped in all groups, in some cases halving during the first year. Although the recession was over by 2010, the recovery was mainly export driven, and domestic demand remained weak. In addition, new waves of depreciation hit FX loan holders. Accordingly, some exporting groups almost reached the pre-crisis level of investment, while in the other two trade groups the fall continued. FX loan holders suffered a greater decline than HUF loan holders in each trade group. In the mismatch groups, the differences remain large even in 2010.

Figure 5
Real investment over time by trade-loan status (2008 = 100)



Left panel shows real investment in 2009 as the share the previous year investment by trade-loan groups. The right panel shows 2010 investments in an analogous way.

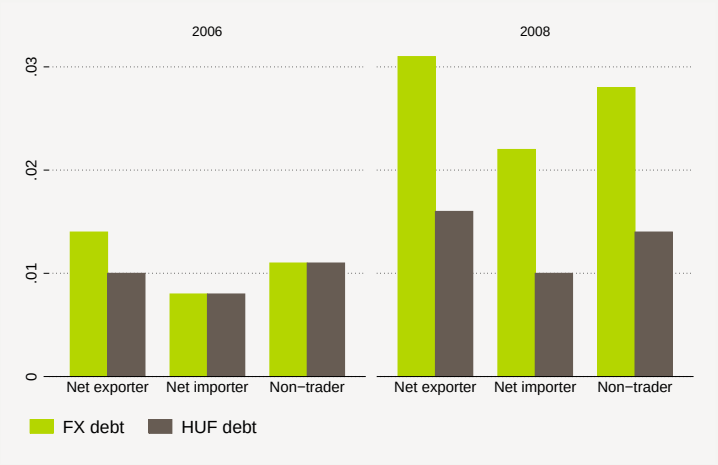
Finally, bankruptcy probabilities (PB) are examined. Figure 6 shows the probability of going bankrupt within 1 year, broken down by subgroups according to trade and loan status. The changes due to the crisis are striking. In 2006, there is little dispersion in PBs between the groups, and firms with HUF debt are as likely to go bankrupt as firms with FX debt. Following the crisis, the differences become large both in terms of the trade and loan status. Firms with FX debt are the most likely to go bankrupt no matter what trade position they have. Even exporters are worse off when they have FX loans.

4.2 CHANGES ON THE LOAN MARKET

In this sub-section we investigate how the loan market evolved over this period, and in particular, whether firms with mismatch were affected to a larger extent. We find a general decline in lending, some signs of stronger liquidity constraints and a disproportional effect on FX lending, especially CHF lending, and on firms with FX loans.

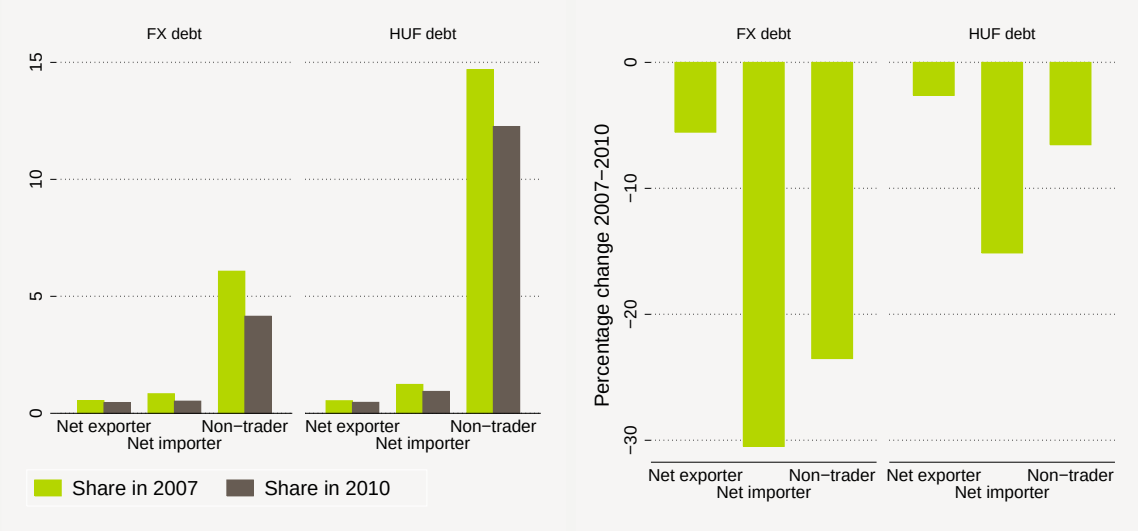
Following the outbreak of the crisis, the decline in the use of loans and in particular of FX loans was strong. While 24% of firms had a loan in 2007, that share dropped to 19% by 2010. The largest relative decline is observed in the mismatch groups. In addition, the difference between FX and HUF debt holders within each trade group suggests that FX debt holders in general were more likely to withdraw or to be cut off from the loan market.

Figure 6
One-year bankruptcy probabilities before and during the crisis



Left panel shows the probability of bankruptcy in the following year for 2006 by trade loan group. The right panel shows the corresponding figures for 2008.

Figure 7
Changes in the composition of the corporate sector by trade loan status



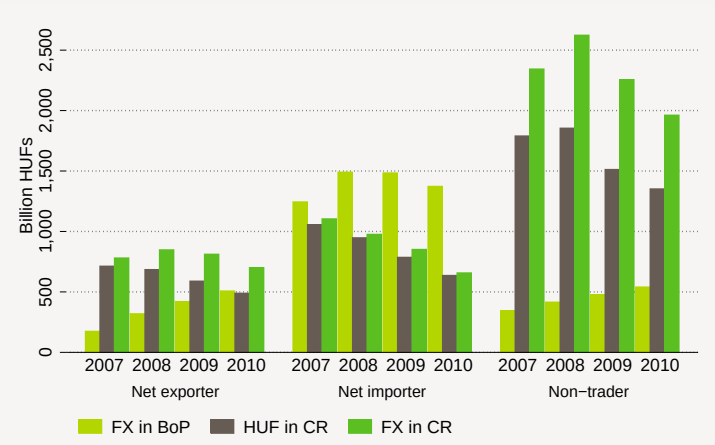
(a) Share of firms

(b) Change in shares

Left panel shows the share of firms with various trade loan statuses. The right panel plots the relative changes in these shares over time.

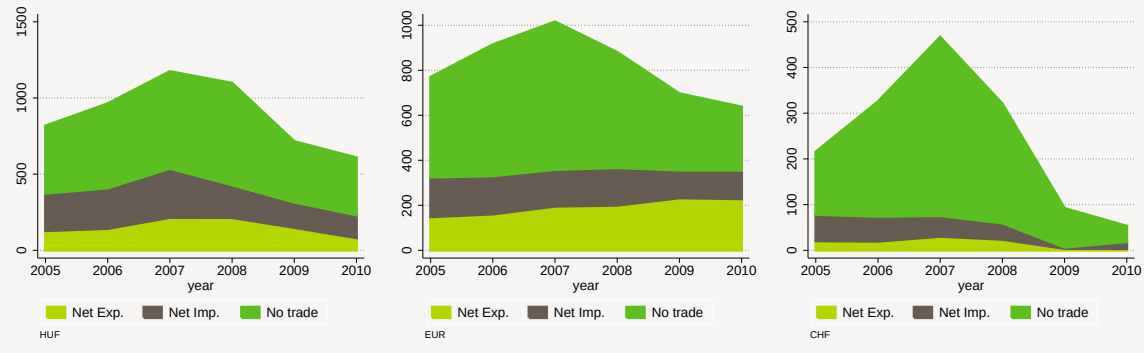
These changes are apparent not just in the number of firms, but are also reflected in loan stocks. The decline both in the number of firms relying on loans and in total debt, however, is attributable to the domestic banking sector. As seen in Figure 8, funding from abroad (not just the stock reported here, but the number of firms) kept rising even after the outbreak of the crisis in all three trade groups, including the no-trade mismatch group. This substitution between the two

Figure 8
Loan stocks by source of debt



The figure shows the stock of debt for firms of different trade status by the denomination of debt and the source: foreign sources (BoP) and domestic sources (CR).

Figure 9
Long-term loan flows by currency and trade status



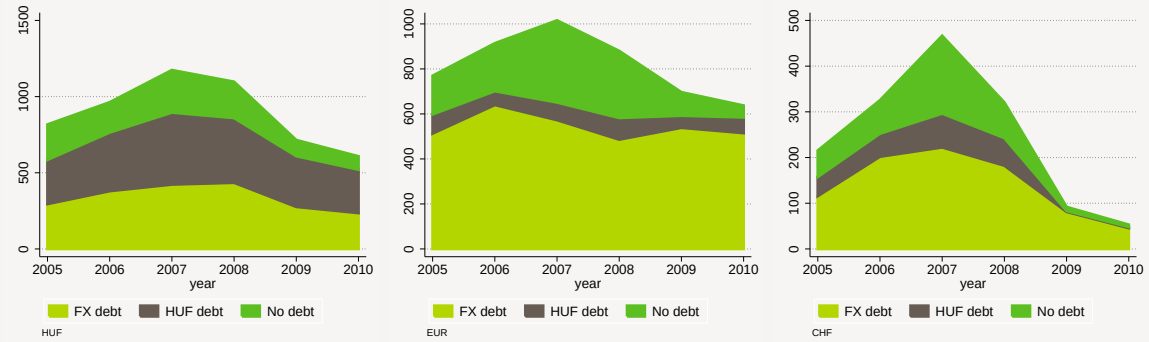
(a) HUF (b) EUR (c) CHF

Figures show the aggregate flow of new loans by the firms trade status last year. We differentiate three denominations: HUF, EUR and CHF.

sources of finance[18] suggests that domestic supply factors played a role. Banks tightening their loan standards and prices may have prodded firms which were capable to switch to foreign sources. Because of the differences in the behaviour on the domestic and foreign loan markets, and partly because of the much richer structure of the data in CR, from now on we

[18] Obviously this substitution was an option for just a set of firms. Firms who have access to the BoP tend to be larger, more likely to be foreign-owned and to be involved in foreign trade.

Figure 10
Long-term loan flows by currency and loan status



(a) HUF (b) EUR (c) CHF

Figures show the flow of loans by the recipient firms' last year debt status. We differentiate three denominations: HUF, EUR and CHF.

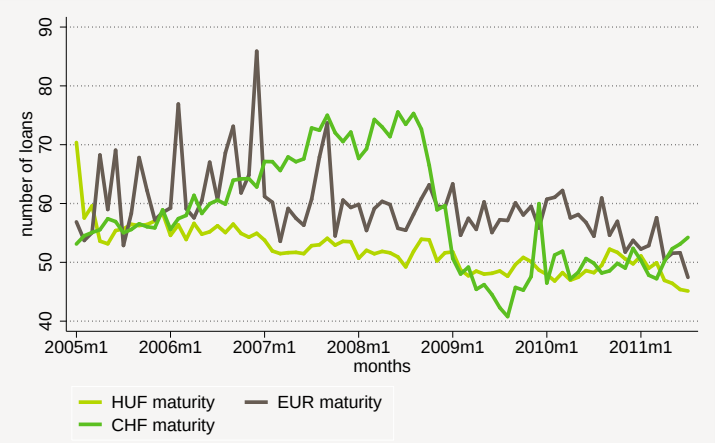
focus on local banks and new long-term lending.[19] An analysis of new loan flows provides some interesting insights on the changes triggered by the crisis, but also on what happened in the build-up phase of currency mismatch.

Figure 10 shows loan flows by currency and by trade groups, where firms are categorised by their trade status for the previous year. The build-up of mismatch positions before the crisis accelerated mainly in the no-trade group and the increase was steeper in CHF than in EUR. The export sector evidently engaged in matching, as export firms took rather EUR loans, in which they have natural hedge. Adjustments due to the crisis were strongest in the no-trade sector and in CHF. Loans denominated in CHF practically disappeared from the market. Looking at the same flows but by loan categories, Figure 10 reveals the changes in liquidity constraints. Before the crisis firms, which did not have a loan in the previous year (upper layer on the graphs) mainly took out CHF and EUR loans, while the value of HUF loan contracts remained stable in this loan category. Before the crisis, the large interest rate differential and the corresponding lower debt burden of FX loans eased firms' liquidity constraint. After 2008, entering the loan market become very unlikely. New entrants disappeared from the CHF segment, but the drop was dramatic on the EUR and HUF loan segments as well.

The decreasing share of new entrants suggests that liquidity constraints became tighter. This is also reflected in the gradually shortening maturity of new long-term loans after the crisis. The maturity reduction is strong in case of CHF loans, while there were smaller changes in the maturity of EUR and HUF loans.

[19] Short-term loans are ignored here. First, companies□ short-term financing needs are less procyclical and can even increase during the crisis. Our data confirm that there is no significant change in the flow of short-term loans. Second, currency mismatch mainly appeared in long-term financing.

Figure 11
Length of new contracts by currency



The figure shows the average maturity of a new loan contract by currency in each month of the sample period.

4.3 TESTING THE EFFECT OF THE TRADE-LOAN STATUS

In the previous sub-section, a strong co-movement was found between firms' loan status and their performance. To investigate the effect of trade loan status on firm performance in a more rigorous and standardised way, we adopt the following estimation strategy:

$$y_{t+j,i} = \Sigma_g \alpha_g TLD_{git} + \gamma y_{it} + \beta X_{it} + \mu_s + \epsilon_{it} \quad (1)$$

The equation relates trade and loan status (TLD) of firm i to its performance which is denoted by y, an outcome variable. The performance measures we are interested in are:[20]

- dummy for getting a long term loan in a given year
- dummy for going bankrupt within the next 1 or the next 2 years
- investment rate, I_t/K_{t-1}

where the dependent variable is a dummy, our specification will be a linear probability model. Our main coefficients of interest are α_g-s on the trade loan status dummies. As we have 9 trade-loan groups, the index g goes from one to nine. Indices t and $t+j$ denote time. The former is used as a base date where firms' trade loan status is defined. The latter is the date, at which future performance is investigated. That is, α_g-s captures the effect of trade loan status at time t on firm performance at a later period, $t+j$, with $j > 0$.

[20] We tested the model for profitability as well, but no significant results were found.

If TLD was exogenous, running regressions using dummies would suffice. However, this is not necessarily the case.

First, the outcome variable can be autoregressive. Consequently, we include y_{it} as regressor. Take investment as an example. As investment is often a multi-step project, a firm which invested last year is likely to invest this year again.[21] More importantly, by including y_{it}, we can catch the correlation between TLD and the outcome variable, e.g. the fact that firms with specific trade or loan status are more profitable. This helps us to separate the effect of an exchange rate change through trade loan status and the correlation of the TLD status with the outcome variable. For example, exporters might do better at all times, having higher output both in t and $t+j$ than other firms. Naturally, in the case of bankruptcy we do not include lagged probability of bankruptcy.

Second, the problem of omitted variables may also arise. Performance measures other than y and other, time-invariant firm characteristics may be correlated with both the performance and the trade-loan status. For example if a firm is more productive than others, it is more likely to be an exporting firm and is more likely to be given a loan by a bank. Consequently we include variables such as TFP, size, foreign ownership and leverage of the firm, as suggested in the section 3.2 on firm characteristics. In equation (1), the control variables are denoted with vector X. We also include sector-fixed effects, μ_s, to control for cross sectoral variation in performance and TLD. We estimate equation (1) without a constant.

The duration of the effects of TLD on performance may vary by outcome variables. The various values of j allows us to look into short-term or medium-term effects. For example, if $j=1$ then we can look at the effect of this year's trade and loan status on next year□s performance. A medium-term effect could be inferred with e.g. $j=3$. In addition, by fixing the time distance to $j=1$, regressions of gradually increasing t provides inference on the time-varying effect of TLD on firms' performance.

We will follow both aforementioned approaches. First (A), to investigate the effect of TLD on one generation of firms, we run regressions increasing j gradually, but keeping t fixed. Second (B), we fix the time distance to $j=1$ and increase t gradually. In this case, the sample of firms and also their TLD status changes as t moves forward. TLD may have different effect on performance because firms adjust their TLD status. Moreover, the size of the FX shock changes as well. Inferences on balance sheet effects can be drawn mainly by using the first approach. Nevertheless, as the exchange rate shocks came in waves, it is worth it to use the second approach as well, even if adjustments in this case may make it difficult to detect balance sheet effects. A priori one cannot know how the adjustment changes the performance and composition of firms with mismatch. Given our data we will use 2007 as the smallest value for t and 3 as the maximum value for j. That is with approach A, we estimate three regressions, $t=2007$ and $j=\{1,2,3\}$. With approach B, we also estimate three regressions, $j=\{1\}$ and $t=\{1,2,3\}$ Having estimated equation 1, we can compare the coefficients. A straightforward way to test the balance sheet effect of depreciation is to compare coefficients on FX-indebted and HUF-indebted loan groups in each trade category. To do this, we test whether $\alpha_{FX}-\alpha_{HUF}$ is positive for each trade loan group. This test is performed, except when we investigate the probability of obtaining a loan. In this case, we are more interested in the changes that take place over time. Here, we allow for structural break in the underlying parameters, as we think economic behaviour, e.g. valuation of risks, might have changed. Therefore, we compare coefficients of the same trade loan group across various equations to see how the probability of obtaining a new loan changed.[22]

[21] See, for example, Chirinko et al. (1999) or Dwenger (2009) on modelling firm-level investment.

[22] The results essentially do not change if we fix the coefficient of the extra controls (e.g. TFP) over time.

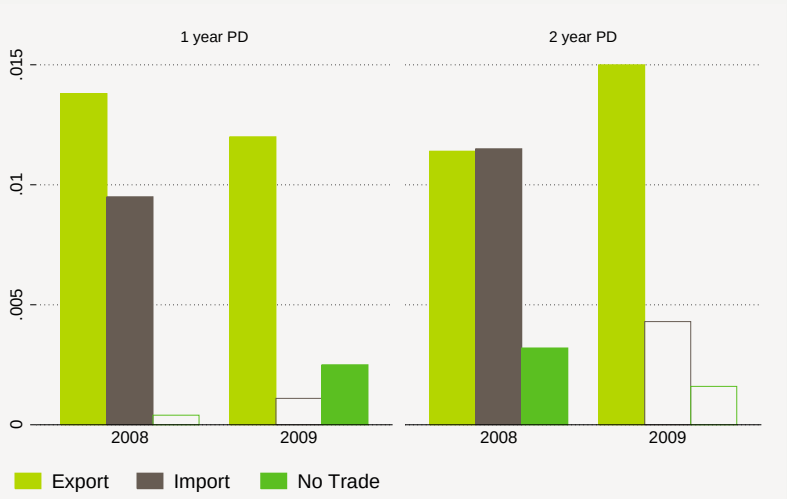
4.3.1 Bankruptcy probabilities

In the case of bankruptcy probabilities, horizons of not just 1 year, but 2 years are used, as bankruptcy announcements spread over time. Table 4 reports the difference between the parameters of FX and HUF loan holders by trade categories, in addition to the test result on the significance of this difference. Before the crisis, (loan-)trade categories significantly affect PBs, in addition to size, TFP and leverage. Nevertheless the choice of FX or HUF loan did not matter: the differences in PBs are small and not significant. By 2008, PB differences increase considerably and become significant. This is in line with the observed jump in bankruptcies in 2009 (recall that PB shows the likelihood of firm going bankrupt by next year), which was the first year of the crisis with a deep recession and a sharp depreciation of HUF.

Table 4
Bankruptcy probability: Coefficient differences $\alpha_{FX} - \alpha_{HUF}$

	2006	2008	2009
1 year PD			
export	0.40%	1.38%***	1.2%***
import	-0.12%	0.95%***	0.11%
no trade	-0.10%	0.04%	0.25%**
2 year PD			
export	-0.07%	1.14%**	1.15%**
import	0.09%	1.15%***	0.43%
no trade	-0.15%	0.32%***	0.16%

Figure 12
Bankruptcy probability: Coefficient differences $\alpha_{FX} - \alpha_{HUF}$



Each bar in the figure represent the difference $\alpha_{FX} - \alpha_{HUF}$ in a trade group. The empty bars show that Wald test on $\alpha_{FX} = \alpha_{HUF}$ is not rejected at any conventional significance level.

In the case of non-traders, FX loan holders have a higher PB in 2008 only at the 2-year horizon. That result could be related to the differences in the spread of bankruptcy over time. The average time between the last APEH report and bankruptcy events is much smaller in case of exporters and larger for non-traders. One likely explanation for this could be that exporters may be more likely to have business partners who initiate the bankruptcy in the case of overdue payment.

The largest estimated effect of FX loans is more than 1 percentage point, which is huge compared to the average 1-year PB in 2009, which was 2% for loan-holders only. As a robustness check, the model was estimated with other control variables, because TFP could strongly correlate with firm performance which was our preferred variable to control for in all the estimations. On the other hand, TFP data was lacking for many firms, due to negative value added.[23] Potentially that causes the most severe problem in the bankruptcy analysis, as firms close to bankruptcy are likely to have irregular capital and value added data. Therefore, TFP was replaced by profitability in one model, and log number of employees and capital in the other. Qualitative results were very similar. A summary table on the different models' result can be found in the Appendix in Tables 11.[24]

4.3.2 Getting a loan

Next, we investigate the changes in access to the loan market by trade loan status, by estimating equation 1. This time, the dependent variable is a dummy which takes on the value one if the firm is able to secure a new long-term loan next year. We examine access to loans of any denomination, but we also look at HUF-, EUR- and CHF-denominated loans separately. The regression results are collected in Tables 13 to 16 in the Appendix.

Table 5
Loan: Differences in TLD coefficients over time

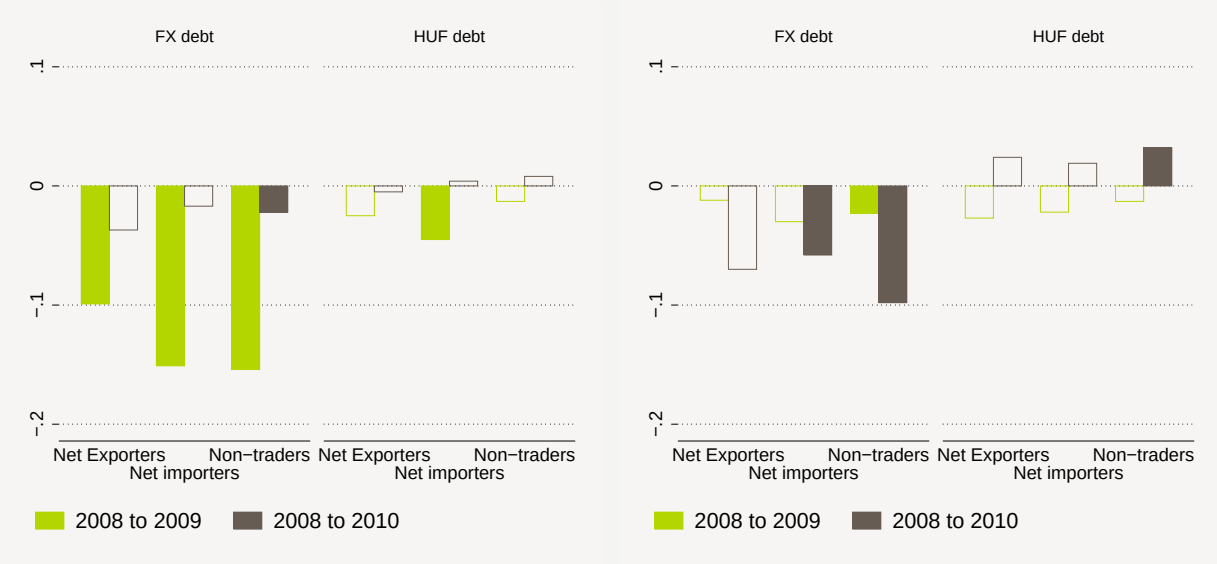
		approach A		approach B	
relate year		2008	2008	2008	2009
to year		2009	2010	2009	2010
Net exporters	FX	-0.099***	-0.037	-0.012	-0.070***
	HUF	-0.025	-0.005	-0.027	0.024
Net importer	FX	-0.151***	-0.017	-0.030	-0.058***
	HUF	-0.045***	0.004	-0.022	0.019
Non-trader	FX	-0.154***	-0.022***	-0.023***	-0.098***
	HUF	-0.013	0.008	-0.013	0.032***

To assess how the probability of receiving a long-term loan might have been affected by the trade loan status, we compare the changes of estimated α coefficients of each trade loan group over time. The differences are collected in Table 5 and presented in Figure 13. Looking at the 2007 sample of firms reveals that for firms already indebted in FX the chances of securing a long-term loan during the next year decreased. For HUF-indebted firms, this effect is practically zero. We also find, that the decline for FX debtors is mostly a short-term effect. Now we take approach B and look at firms with

[23] Missing TFP data were replaced by the lowest 1st percentile, however because of the large number of replacements that could distort our results.

[24] In the estimation of models where bankruptcy frequency rather than PB is modelled (for the year when bankruptcy occurred rather than for the sample of existing firms in a given year), similar results are found. These findings were robust to changes in the bankruptcy indicators. When 1 and 3 years were allowed to pass between the last financial report and the announcement of bankruptcy, the results were very similar both qualitatively and quantitatively. These results are not reported, but are available on request.

Figure 13
Loan: Differences in TLD coefficients over time



(a) approach A

(b) approach B

Each bar shows the difference of $\alpha_{g,t} - \alpha_{g,t-1}$ for each TLD. The left panel shows (2007 based) equations that refer to 2008 loan probabilities, while right panel shows short run effects with a rolling base. The empty bars show that F-test on $\alpha_{g,t} = \alpha_{g,t-1}$ is not rejected at any conventional significance level.

changing status. We find that for FX-indebted firms the probability of obtaining a loan declines over the entire period. The phenomenon is more pronounced in the case of non-traders and net importers. At the same time, we do not find significant a decline or increase for HUF-indebted firms. Comparing the results for FX-indebted and HUF-indebted firms suggests a possible balance sheet effect. When looking at probabilities of obtaining a loan by currency denomination, patterns are less clear cut. For CHF loans we find a clear pattern that shows the disadvantage of FX-indebted firms, especially those faced with mismatch.

4.3.3 Investment

To assess whether the investment behaviour of firms across trade-loan groups differed, we run a regression as defined by equation 1 with the investment rate as a dependent variable. We are interested in coefficient differences between HUF-indebted and FX-indebted firms within trade categories. The differences are collected in Table 4.3.3 and presented in Figure 14.[25] Looking at the 2007 generation of firms, in the short term only the non-trading HUF debtors significantly outperform FX debtors. In the longer term, j being 2 or 3, we find that FX debtors are always significantly outperformed. FX debtors suffered the largest drop in investment, but net importers and non-trading firms with HUF loans also reduced their investment rate. If we take into account that 2007 firms changed their TLD status over the sample period, our results are unchanged. As the right panel of Fig. 14 suggests, the difference between FX-indebted and HUF-indebted firms remains significant. In addition, we find that the difference is only detectable across net importers and non-trading firms.

[25] The detailed results are in the Appendix in Table 12.

Table 6
Investment: Differences in HUF and FX coefficients

	approach A			approach B		
t	2007	2007	2007	2007	2008	2009
t+j	2008	2009	2010	2008	2009	2010
Net exporter	-0.003	0.018*	0.019**	-0.003	0.0026	-0.0061
Net importer	0.0134	0.021***	0.024***	0.0134	0.0174**	0.023***
Non-trader	0.014***	0.013***	0.011***	0.014***	0.018***	0.014***

4.4 MISMATCH IN 2010

As we have seen, firms with mismatch were hit harder, and both banks and firms made efforts to lower their exposure by escaping from the mismatch status. Both the balance sheet effects and the ensuing adjustments contributed to the decline in the weight of mismatched firms in the economy. The share of firms with mismatch decreased from 7% to 4 %. In the aggregate stock of loans, their share changed by only 1 percentage point from 2007 to 2010; the fall is 2.5 percentage points when the domestic loan portfolio is considered. In the case of aggregate value added, investments or employment, the decline is more significant. The share of mismatch firms in value added drops from 23 to 21 percent, while the corresponding figures for employment are 17 and 13 percent. In the case of investment, the share fell from 29 to 22 percent by 2010. The more sluggish adjustment in the loan market may be due to the longer-term nature of FX loans, the depreciation of which directly increased the value and share of FX loans, and the general deleveraging carried out by banks.

Figure 14
Investment: Differences in HUF and FX coefficients

(a) approach A

(b) approach B

Each bar in the figure represent the difference $\alpha_{HUF} - \alpha_{FX}$ in a trade group. The left panel shows 2007 based equations, while the right panel shows short run effects with a rolling base. The empty bars show that Wald test on $\alpha_{HUF} = \alpha_{FX}$ is not rejected at any conventional significance level.

5 Conclusion

The sub-prime crisis triggered a third-generation type currency crisis in the case of Hungary. Foreign exchange exposures and balance sheet effects played a critical role in the unfolding of the crisis. The aim of this paper was to investigate the issue of mismatch in the Hungarian corporate sector. In order to judge the importance of mismatch and the related balance sheet effects, one needs firm-level data, as aggregate data can be misleading when exposures are heterogeneous across firms. This has become possible by a recently compiled firm-level dataset. The uniqueness of that dataset comes from its almost full coverage of the corporate sector and the inclusion of not just net foreign currency liabilities (both from domestic and foreign sources), but net foreign currency revenues as well. Firms are defined to have currency mismatch when they have foreign currency liabilities without foreign currency revenue from net exports. We distinguished two mismatch groups based on trade status: those who are net importers and those who do not trade at all. First, we assessed the macroeconomic importance and characteristics of firms with mismatch in 2007. Then, we investigated their behaviour during the crisis. We examined the existence of balance sheet effects by comparing the behaviour and performance of mismatched firms during the crisis with that of their peers. Taking a snapshot at the last pre-crisis year, we found that although mismatch firms make up only 7% of all firms in 2007, they have a sizeable share in various aggregates. Their weight is largest in the total loan portfolio, as 2/3 of all loans are at mismatched firms. Their contribution to investment and value added is smaller but still high, at 29% and 23% respectively. Given their high share in loan aggregates, their impact on real output could be larger than reflected by their share in output or investment since their balance sheet problems may contaminate the banking sector as well, and activate the bank lending channel. The average characteristics of firms with currency mismatch differ significantly from others in various dimensions. Firms with mismatch tend to be larger than their peers (firms in the same trade category, but with HUF loans). There is no difference in the share of foreign-owned companies however. Firms with foreign currency loans tend to be more indebted on average than their counterparts. During the period when mismatch was building up, low exchange rate volatility and the large interest rate differential persisted. Cheaper FX loans eased liquidity constraints and allowed larger leverage. We found much larger differences between traders and non-traders and between those firms which have loans and those which do not than between mismatched firms and their peers. Consequently, large differences are detected between the two mismatch groups in different trade categories (importers vs. non-trading firms). These two groups turned out to be very different in many dimensions, not just in terms of leverage and size, but in respect of foreign ownership and productivity as well. Their behaviour during the crisis also diverged. The performance of firms with FX liabilities was inferior during the crisis. We found ample evidence that firms with FX loans, especially firms with mismatch were hit harder and had to adjust more than their peers. Their probability of making profit and their survival rate declined more than that of HUF loan holders in the same trade group. In line with their relatively worse balance sheets and default probabilities, their creditworthiness was more likely to be reassessed by banks. Moreover, the domestic banking sector faced severe external and in particular FX liquidity shortages, which forced them to lower their (gross) FX exposures. While before the crisis an FX loan may have seemed a good idea for firms, the large volatility and depreciation of HUF forced firms to realign their financial structure. Thus, both supply and demand factors caused adjustments on the loan market. CHF loans, which were mainly responsible for the building up of mismatch positions, disappeared from the market. The maturity of long-term loans declined. There was a general fall in the probability of obtaining a new loan, but the most affected groups again were those with mismatch problems. Interestingly, the adjustment is observed on the domestic loan market, while foreign sources rather acted as a substitute for domestic loans. Firms□ deteriorating financial performance together with the tightening liquidity constraints resulted in historically low investment performance, and again the most severely affected groups were those with FX liabilities. All of these results suggest that the waves of

currency depreciation during the crisis triggered significant balance sheet effects and adjustments, both in the corporate sector and in the domestic banking sector. As a result, by 2010 the macroeconomic importance of mismatched firm had declined somewhat. The decline was the smallest in the loan portfolio, which can be rather attributed to the slowly changing stock nature of long-term loans.

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Appendix A Data

A.1 CREDIT REGISTER

The original database includes all loan contracts of firms with domestic financial institutions from 2005. Information available on contract characteristics are the date of contract, expiration and termination, value, currency, type of loan provider and type of the contract.

We exclude some of the contracts. First, we exclude off balance sheet items like guarantees. Four types of contracts are included: loans, credit lines, factoring and leasing. Moreover, only contracts with banks, savings banks and financial companies are considered.

The original data has a dual structure. From January 2005 to December 2009, it is a cross-section of the contracts, that is only one observation is available for each contract. From January 2010 on, the status of all existing contracts are reported monthly. Hence, it can be considered as a monthly unbalanced panel. Consecutive reports update information on contract status, therefore, we take the last known information on, e.g., termination date or contracted value.

One shortcoming of the database is that it contains contracted rather than actual outstanding value of the debt. Therefore these have to be constructed. We take the following approach. First, we distinguish contracts by duration.[26] In the case of the long contracts, we assume linear repayment - which is the typical repayment scheme in Hungary - without any grace period. For the short contracts, an average utilization rate is calculated by dividing the actual outstanding short-term loan stock (reported in banks' balance sheet) by the total value of short-term contracts in each month. For all short contracts this common utilization rate is assumed independently from the provider or the firm.

Information on default is not used to correct the stocks. First, because of the cross-section structure of the data before 2010, which implies that for the period only the last default event is known. Second, defaults are reported in waves and data on default is considered unreliable. As defaulted loans neither pay interest nor capital installment, the actual outstanding stock is larger than calculated in our dataset.

For some contracts, the expiration date and the termination date do not coincide, furthermore the termination date is greater than the expiration date. For these contracts it is assumed that they are renewed and the value of the renewed contracts are corrected for the inflation.

The end-of-year stocks are used in the main database. As the credit register database has full coverage only from 2005, in order to lengthen the panel database we use the January 2005 stocks as a proxy for December 2004.

Figure 15 compares the loan stocks calculated from the credit register with that from supervisory report of banks. There is a gap between the two, the aggregated data calculated from the credit register stock remains above actual. However the dynamics is very similar. The difference could come from different sources. First the structure of the two datasets is different, precise comparison cannot be done. footnote: Nevertheless the comparison was very useful when the CR

[26] Duration does not necessarily refers to length in common parlance as short contracts are considered as roll-over loan contracts used for short term financing, while long contracts are used for investment projects.

dataset was cleaned. Second, as CR includes contractual values, actual outstanding loan stocks are calculated using several assumptions. Figure 16 gives a more detailed comparison.

Figure 17 shows the distribution of the yearly stocks by the loan provider. Most of the lending is through banks, other providers have small share in the total stock.

Figure 18 presents the division of loan stock by duration and currency type. Short loan is predominantly HUF, some is provided in EUR, but the pattern remains the same throughout the whole period. In case of long contracts, the pattern is quite different. From the beginning, lending in foreign currency was as important as in HUF, moreover, foreign currency lending increased significantly before the crisis. EUR is the most important currency, however, CHF lending was considerable too.

Loan stocks by type of loan contract is presented by Figure 19.

A.2 BALANCE OF PAYMENT

Balance of Payments (BoP) contains monthly information on financial flows and stock of liabilities/assets by currencies between Hungarian firms' and nonresidents. Firm level data has become available only with the change of the data collection mechanism in 2008. Since then not just flows but monthly stocks are reported as well. We use information on outstanding loans from non-FDI sources. We disregard trade loan and information on derivatives, both of negligible magnitude and taking them into account would not change the results.

As some firms lend to foreign firms, the net stock is calculated.

Similarly to the credit register, in order to lengthen the main panel database, we use January 2008 data for December 2007.

A.3 APEH

The APEH dataset is provided by the National Tax and Customs Authority (NAV) and it contains information on double bookkeeping firms subject to capital taxation. The prime source of the data is the tax reports of firms. It contains the balance sheets and income statements, hence information on assets and liabilities, on sales, on exports, on expenses and on profits for a given tax year.

Beyond these, firms provide additional information on average annual employment, and on ownership structure (distinguishing among foreign and domestic, private, state and municipal ownership). The sectoral classification of firms is available at the four digit TEAOR'08 classification, which is the Hungarian equivalent of NACE rev.2.

The sample of APEH used in this study ranges from 2004 to 2010. We drop state or municipality owned firms from the sample as we focus on the private sector. In addition, as we do not want to deal with the specific features of the financial sector, we drop banks and financial firms along with special purpose entities. The remaining dataset contains about 300 to 380 thousand firms per year as shown in Table 8.

In parts of the paper, where broader classification is sufficient, we form the following 11 industry groups (the corresponding 2 digit TEAOR'08 codes are in brackets): 1. Agriculture and Mining (1-9), 2. Manufacturing (10-33), 3. Energy (35), 4. Construction (41-43), 5. Retail and wholesale services (45-47) 6. Logistics (49-53), 7. Hotels and Restaurants (55-56), 8. Communication services (58-63), 9. Real estates (68), 10. Technical and support services (69-82) 11. Other services (85-99).

In order to use the balance sheet data to calculate real performance measures, e.g., value added or total factor productivity, deflators provided by the Hungarian Central Statistical Office are used. The deflators are at 2 digit sectoral level and allow to express real measures in 2005 terms.

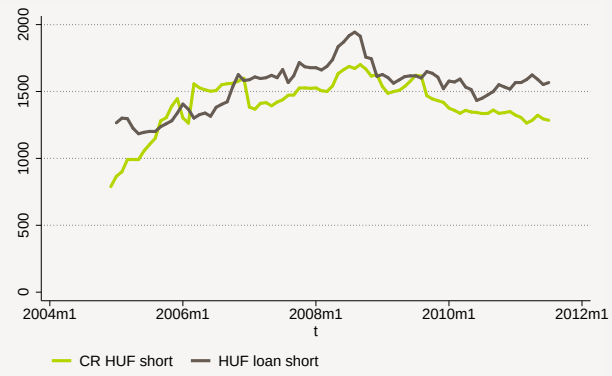
A.4 BANKRUPTCY

To construct bankruptcy rates we use a database compiled by a private company using court announcements on various forms of bankruptcy proceedings . The database contains the timing and type of proceeding. There are four major types of bankruptcy procedures: (a) liquidation due to insolvency, initiated by the creditors; b) restructuring, initiated by the debtor, which aims to ensure the going concern of the troubled (insolvent) firm (c) the company is dissolved due to reasons other than insolvency; (d) termination by court order. The former two are regarded as bankruptcy while the latter two as exit. The bankruptcy time-series generated this way is modified due to duplications and specific features of the Hungarian bankruptcy practice. First, any time a debtor initiate bankruptcy, that will be announced. If there are multiple announcements on the same firm within a year (many debtors can initiate bankruptcy against the same firm and they all will be announced), we treat them as duplicates and use only the first date of announcement. Second, many of the exits later turn into bankruptcy - the involved firm turns out to be insolvent later, thus a liquidation procedure is initiated against it. In that cases we use the announcement date of the exit as the date of bankruptcy (unless more than 1 year passes between the two).

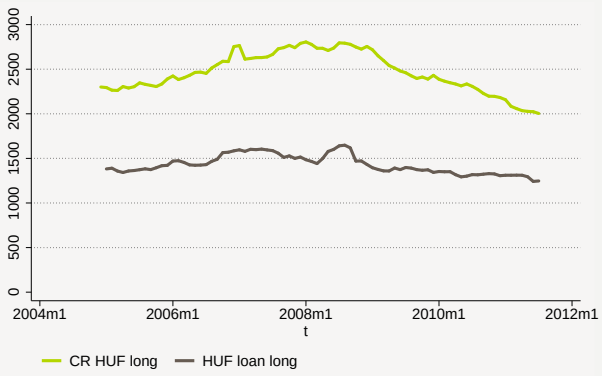
The bankruptcy database is merged with the others to include denomination of loan, export status, size, foreign ownership etc. using the last available financial report. Based on the merged dataset, we learned that often many years elapses between the last financial report of the company and the announcement of bankruptcy. Taking the sample of firms existed in 2004 about half of all bankruptcies occur in the first 2 years (30% and 20%). The other half spreads over the following years, 6% even in 2011. We also found, that the pattern is different across firm classes. For example the average time between the last report and bankruptcy is smaller for exporting firms than for no-traders.

Figure 15
Total loans from CR vs banks' balance sheets

Figure 16
CR vs banks' balance sheets: detailed comparison

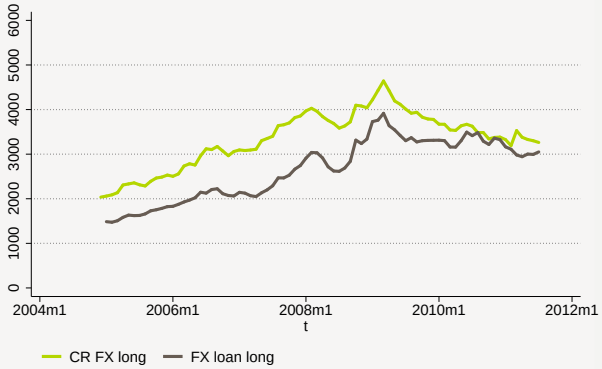


(a) Short HUF



(b) Long HUF

(c) Short FX



(d) Long FX

Figure 17
CR data by loan provider

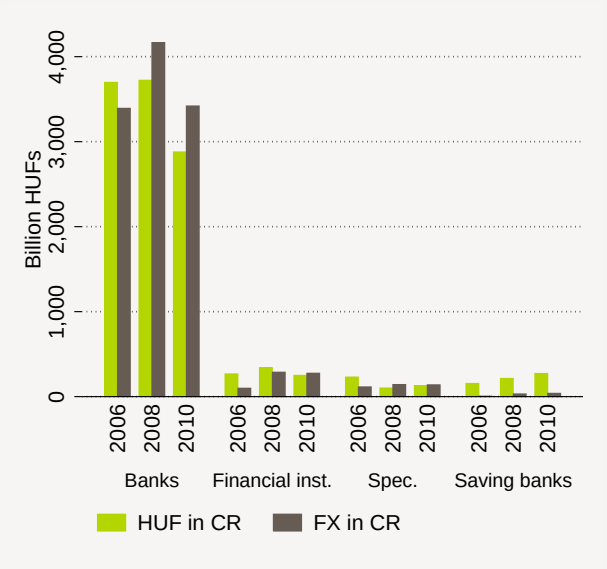


Figure 18
CR by duration and denomination

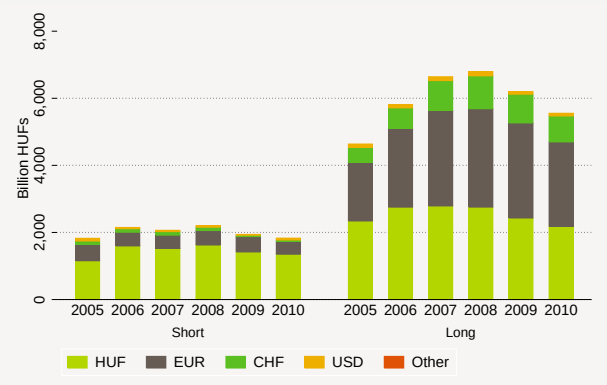


Figure 19
CR data by loan types

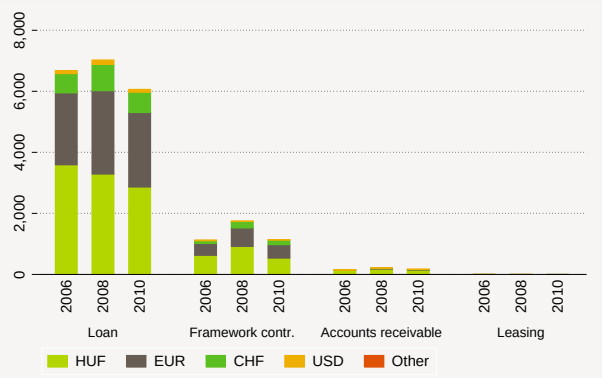


Table 7
Number of observations by year

year	# obs.
2004	309,206
2005	321,625
2006	329,212
2007	339,729
2008	355,602
2009	366,157
2010	380,456

Table 8
Descriptive statistics from APEH for 2007

Variables	# obs.	Mean	Std. Dev.
employment	291,928	7.486	77.255
real value added (Billions 2005 terms)	339,534	0.033	1.375
foreign ownership (dummy)	339,729	0.080	0.271
exporter (dummy)	339,729	0.029	0.167
TFP* in logs	197,497	6.306	1.346
leverage	339,729	0.061	0.166

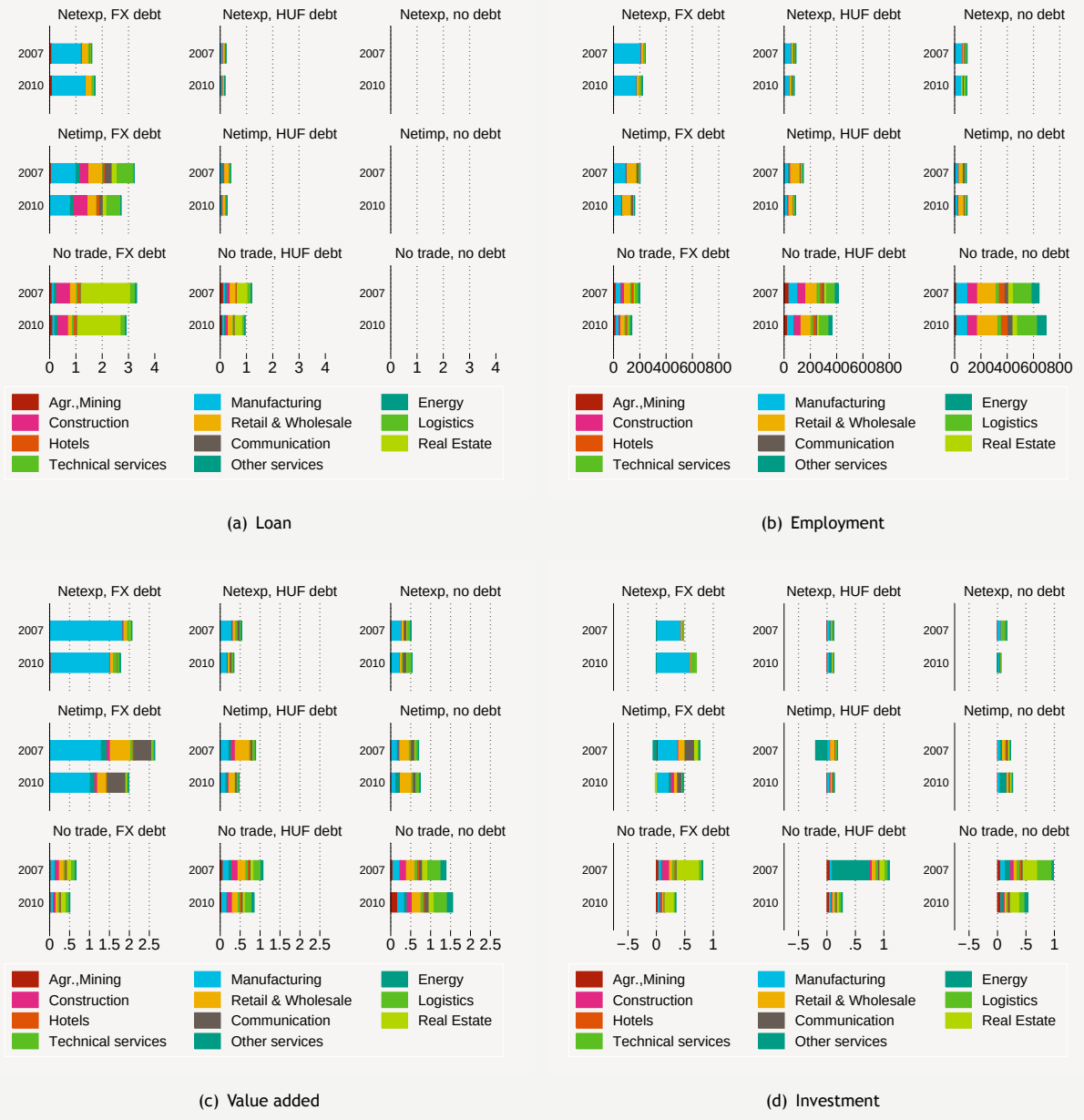
* Levinsohn-Petrin (2003)

Appendix B Tables and Figures

Table 9
Number of firms by categories and year

	2007	2008	2009	2010
Netexp, FX debt	1,840	2,037	1,942	1,738
Netexp, HUF debt	1,831	1,968	1,794	1,783
Netexp, no debt	2,845	2,892	3,017	3,332
Netimp, FX debt	2,847	2,770	2,386	1,979
Netimp, HUF debt	4,197	3,893	3,717	3,562
Netimp, no debt	6,552	6,376	6,583	7,127
No trade, FX debt	20,638	2,191	19,249	15,785
No trade, HUF debt	49,907	50,858	48,341	46,643
No trade, no debt	249,072	262,898	279,128	298,507
Total	339,729	355,602	366,157	380,456

Figure 20
Firm categories' weight in macro aggregates by industries



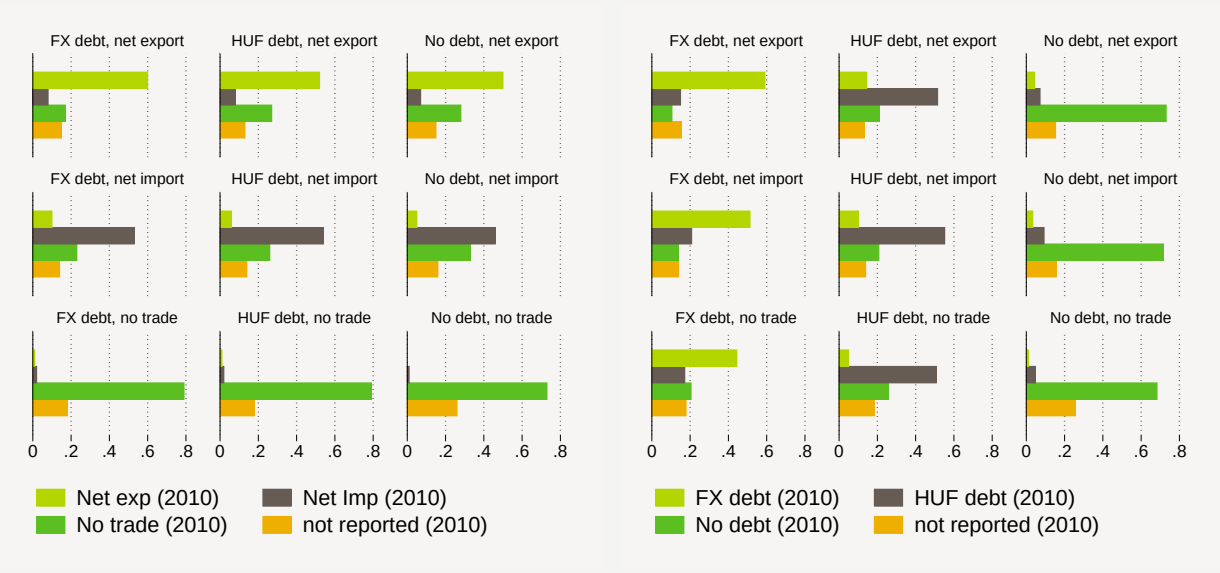
(a) Loan

(b) Employment

(c) Value added

(d) Investment

Figure 21
Movements between trade and loan categories from 2007 to 2010



(a) by trade

(b) by loan

Panel (a) holds 9 blocks for each trade-loan subgroup and looks at changes according to trading activity. For example far northwest corner block for FX, net exporters shows what share of firms with this status in 2007 remain next exporter, what share becomes net importer and what share will give up trade or exit. Analogously, panel (b) holds 9 blocks for each trade-debt subgroup and looks at movements in terms of debt status. For example far northwest corner block for FX, net exporter shows what share of firms with this status in 2007 remain FX debt holders, what share became HUF debt holder and what share has no debt at all or exited by 2010.

Table 10
Yearly transition matrices across trade-loan statuses 2007-2010

status at year t	status at year t+1									
		Net exp			Net Imp			No trade		Exit
2007 to 2008	FX	HUF	no	FX	HUF	no	FX	HUF	no	
Netexp FX debt	**66.85**	5.82	3.10	5.92	0.98	0.27	9.73	1.63	0.98	4.73
Netexp HUF debt	9.23	**53.19**	6.12	0.71	6.06	0.60	1.26	16.22	2.29	4.31
Netexp no debt	2.88	4.43	**58.98**	0.42	0.70	6.01	0.42	1.41	18.88	5.87
Netimp FX debt	5.73	0.81	0.35	**62.49**	6.60	3.02	13.70	1.55	1.30	4.46
Netimp HUF debt	0.52	4.12	0.48	6.98	**57.95**	6.31	1.57	15.53	2.19	4.34
Netimp no debt	0.27	0.40	3.75	2.21	5.36	**56.88**	0.49	1.94	23.12	5.57
No trade FX debt	1.23	0.16	0.09	1.35	0.19	0.06	**74.59**	7.77	8.50	6.06
No trade HUF debt	0.08	0.81	0.08	0.10	0.97	0.14	4.37	**74.04**	12.25	7.16
No trade no debt	0.01	0.03	0.23	0.02	0.07	0.59	1.12	3.54	**82.31**	1.21
2008 to 2009										
Netexp FX debt	**65.00**	5.69	3.39	5.94	0.54	0.83	10.65	2.11	0.64	5.20
Netexp HUF debt	4.52	**51.47**	7.98	0.36	6.40	0.76	0.81	19.87	3.35	4.47
Netexp no debt	1.56	2.25	**60.17**	0.21	0.45	7.30	0.24	1.11	20.99	5.74
Netimp FX debt	6.35	0.58	0.43	**59.35**	7.98	4.44	12.85	1.44	1.30	5.27
Netimp HUF debt	0.41	3.29	0.59	3.70	**61.65**	7.09	0.44	15.87	2.57	4.39
Netimp no debt	0.06	0.20	4.09	1.07	3.14	**59.22**	0.24	1.13	24.73	6.12
No trade FX debt	0.95	0.16	0.06	1.44	0.17	0.09	**74.50**	7.23	8.22	7.17
No trade HUF debt	0.07	0.69	0.10	0.05	1.10	0.14	1.69	**75.68**	12.87	7.60
No trade no debt	0.01	0.01	0.21	0.01	0.04	0.59	0.38	2.08	**84.36**	12.30
2009 to 2010										
Netexp FX debt	**64.16**	4.48	4.02	6.85	0.57	0.57	10.66	1.60	0.93	6.18
Netexp HUF debt	3.96	**54.85**	8.14	0.28	7.25	0.50	0.17	17.61	2.17	5.07
Netexp no debt	1.09	2.09	**62.74**	0.17	0.33	6.50	0.07	0.99	20.19	5.83
Netimp FX debt	7.38	0.84	0.38	**59.51**	6.96	4.53	12.57	1.55	1.30	4.99
Netimp HUF debt	0.22	4.06	0.54	1.83	**61.15**	8.10	0.32	16.22	2.23	5.33
Netimp no debt	0.02	0.24	4.25	0.58	2.89	**59.68**	0.03	0.91	24.37	7.03
No trade FX debt	0.88	0.15	0.05	1.36	0.13	0.09	**74.46**	6.93	8.59	7.38
No trade HUF debt	0.02	0.75	0.07	0.03	1.23	0.14	0.55	**77.65**	12.07	7.48
No trade no debt	0.00	0.02	0.26	0.01	0.04	0.66	0.13	1.86	**85.56**	11.46

Table 11
Robustness of bankruptcy results

trade category	PB horizont	control variable	α(FX) - α(HUF)		
			2006	2008	2009
Net exporter					
		profitability	–	+	+
	1year	TFP	–	+	+
		size, capital	–	+	+
		profitability	–	+	+
	2year	TFP	–	+	+
		size, capital	–	+	–
		profitability	–	+	–
Net importer					
	1year	TFP	–	+	–
		size, capital	–	+	–
		profitability	–	+	–
	2year	TFP	–	+	–
		size, capital	–	+	–
		profitability	–	–	+
Non-trader					
	1year	TFP	–	–	+
		size, capital	–	–	–
		profitability	–	+	–
	2year	TFP	–	+	–
		size, capital	–	+	–

–: not significantly different

+: α(FX) > α(HUF), the difference is significant

Table 12
Effects on investment rate

Dep. Var.: $(I/K)_{t+j}$	[1]	[2]	[3]	[4]	[5]
method		approach A			approach B
t	2007	2007	2007	2008	2009
t+j	2008	2009	2010	2009	2010
Net exporters					
FX debt	0.0581***	0.0678***	0.0217**	0.0521***	-0.0023
	[0.00933]	[0.00898]	[0.00867]	[0.00841]	[0.00836]
HUF debt	0.0555***	0.0856***	0.0413***	0.0547***	-0.008
	[0.00960]	[0.00946]	[0.00902]	[0.00873]	[0.00861]
no debt	0.0508***	0.0898***	0.0505***	0.0660***	0.0149*
	[0.00945]	[0.00928]	[0.00899]	[0.00913]	[0.00845]
Net importer					
FX debt	0.0441***	0.0604***	0.0156**	0.0338***	-0.017**
	[0.00864]	[0.00805]	[0.00791]	[0.00787]	[0.00808]
HUF debt	0.0575***	0.0814***	0.0399***	0.0512***	0.00513
	[0.00782]	[0.00743]	[0.00752]	[0.00740]	[0.00754]
no debt	0.0785***	0.0878***	0.0530***	0.0626***	0.0127*
	[0.00777]	[0.00742]	[0.00728]	[0.00740]	[0.00714]
Non trader					
FX debt	0.0132**	0.0436***	0.000601	0.0155***	-0.042***
	[0.00556]	[0.00562]	[0.00525]	[0.00543]	[0.00518]
HUF debt	0.0269***	0.0567***	0.0110**	0.0332***	-0.028***
	[0.00498]	[0.00511]	[0.00468]	[0.00496]	[0.00472]
no debt	0.0382***	0.0752***	0.0259***	0.0545***	-0.00608
	[0.00452]	[0.00471]	[0.00425]	[0.00455]	[0.00427]
TFP	0.0245***	0.0173***	0.0140***	0.0209***	0.0212***
	[0.000523]	[0.000539]	[0.000566]	[0.000473]	[0.000473]
Leverage	-0.00385	-0.00823	-0.0124**	-0.00576	-0.0138**
	[0.00644]	[0.00613]	[0.00629]	[0.00542]	[0.00548]
I/K_t	0.152***	0.0907***	0.0744***	0.130***	0.150***
	[0.00306]	[0.00280]	[0.00286]	[0.00285]	[0.00312]
Dummy: took out loan	yes	yes	yes	yes	yes
Foreign dummy	yes	yes	yes	yes	yes
Dummy: size	yes	yes	yes	yes	yes
Dummy: sector	yes	yes	yes	yes	yes
Dummy: year	yes	yes	yes	yes	yes
Observations	138486	130340	121883	141928	142943
R-squared	0.184	0.128	0.122	0.144	0.153

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 13
Probability of taking a new loan at $t+j$

Dep. Var.: $loan_{t+j}$	[1]	[2]	[3]	[4]	[5]
method		approach A		approach B	
t	2007	2007	2007	2008	2009
t+j	2008	2009	2010	2009	2010
Net exporters					
FX debt	0.519***	0.420***	0.383***	0.507***	0.437***
	[0.0138]	[0.0142]	[0.0141]	[0.0134]	[0.0135]
HUF debt	0.312***	0.287***	0.282***	0.285***	0.309***
	[0.0130]	[0.0132]	[0.0127]	[0.0123]	[0.0125]
no debt	0.0179***	0.0608***	0.0985***	0.0382***	0.0859***
	[0.00569]	[0.00813]	[0.00736]	[0.00628]	[0.00627]
Net importer					
FX debt	0.538***	0.387***	0.370***	0.508***	0.450***
	[0.0116]	[0.0120]	[0.0119]	[0.0118]	[0.0124]
HUF debt	0.308***	0.263***	0.267***	0.286***	0.305***
	[0.00955]	[0.00983]	[0.00955]	[0.00977]	[0.00974]
no debt	0.0281***	0.0723***	0.114***	0.0423***	0.0959***
	[0.00555]	[0.00719]	[0.00677]	[0.00582]	[0.00598]
Non trader					
FX debt	0.454***	0.300***	0.278***	0.431***	0.333***
	[0.00700]	[0.00729]	[0.00718]	[0.00726]	[0.00743]
HUF debt	0.227***	0.214***	0.222***	0.214***	0.246***
	[0.00575]	[0.00626]	[0.00625]	[0.00594]	[0.00616]
no debt	0.0343***	0.0623***	0.106***	0.0461***	0.0991***
	[0.00499]	[0.00557]	[0.00559]	[0.00525]	[0.00548]
TFP	0.00500***	0.0127***	0.00771***	0.00588***	0.00479***
	[0.000511]	[0.000574]	[0.000523]	[0.000495]	[0.000448]
Leverage	0.393***	-0.069***	0.00162	0.353***	0.241***
	[0.00883]	[0.00781]	[0.00761]	[0.00833]	[0.00824]
Dummy: took out loan at t	yes	yes	yes	yes	yes
Foreign dummy	yes	yes	yes	yes	yes
Dummy: size	yes	yes	yes	yes	yes
Dummy: sector	yes	yes	yes	yes	yes
Dummy: year	yes	yes	yes	yes	yes
Observations	175,920	164,945	156,251	141928	142943
R-squared	0.404	0.236	0.207	0.144	0.153

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 14
Probability of taking HUF loan

Dep. Var.: $loan_{t+j}$	[1]	[2]	[3]	[4]	[5]
method		approach A		approach B	
t	2007	2007	2007	2008	2009
t+j	2008	2009	2010	2009	2010
Net exporters					
FX debt	0.189***	0.223***	0.196***	0.207***	0.183***
	[0.0123]	[0.0124]	[0.0118]	[0.0117]	[0.0111]
HUF debt	0.276***	0.214***	0.191***	0.267***	0.254***
	[0.0125]	[0.0119]	[0.0113]	[0.0119]	[0.0118]
no debt	-0.00587	0.0427***	0.0688***	0.0237***	0.0543***
	[0.00499]	[0.00683]	[0.00634]	[0.00541]	[0.00527]
Net importer					
FX debt	0.209***	0.225***	0.207***	0.199***	0.194***
	[0.0105]	[0.0106]	[0.0101]	[0.0103]	[0.0102]
HUF debt	0.273***	0.192***	0.182***	0.265***	0.252***
	[0.00918]	[0.00880]	[0.00841]	[0.00935]	[0.00906]
no debt	0.001	0.0594***	0.0829***	0.0293***	0.0648***
	[0.00500]	[0.00633]	[0.00601]	[0.00525]	[0.00527]
Non trader					
FX debt	0.0840***	0.156***	0.166***	0.0981***	0.124***
	[0.00595]	[0.00629]	[0.00629]	[0.00617]	[0.00629]
HUF debt	0.206***	0.153***	0.158***	0.209***	0.208***
	[0.00533]	[0.00559]	[0.00555]	[0.00555]	[0.00560]
no debt	0.00928**	0.0537***	0.0781***	0.0368***	0.0696***
	[0.00462]	[0.00501]	[0.00499]	[0.00491]	[0.00497]
TFP	0.00402***	0.00952***	0.00532***	0.00516***	0.00298***
	[0.000456]	[0.000489]	[0.000448]	[0.000431]	[0.000388]
Leverage	0.323***	-0.017***	0.0273***	0.286***	0.243***
	[0.00820]	[0.00665]	[0.00661]	[0.00759]	[0.00748]
Dummy: took out loan	yes	yes	yes	yes	yes
Foreign dummy	yes	yes	yes	yes	yes
Dummy: size	yes	yes	yes	yes	yes
Dummy: sector	yes	yes	yes	yes	yes
Dummy: year	yes	yes	yes	yes	yes
Observations	175920	164945	156251	176917	174495
R-squared	0.278	0.153	0.136	0.25	0.211

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 15
Probability of taking EUR loan

Dep. Var.: $loan_{t+j}$	[1]	[2]	[3]	[4]	[5]
method		approach A		approach B	
t	2007	2007	2007	2008	2009
t+j	2008	2009	2010	2009	2010
Net exporters					
FX debt	0.165***	0.142***	0.163***	0.198***	0.261***
	[0.00983]	[0.00979]	[0.0102]	[0.0101]	[0.0110]
HUF debt	-0.013***	0.0345***	0.0548***	-0.014***	0.0195***
	[0.00178]	[0.00569]	[0.00592]	[0.00211]	[0.00327]
no debt	-0.007***	0.0112***	0.0378***	-0.006***	0.0278***
	[0.00156]	[0.00360]	[0.00417]	[0.00201]	[0.00319]
Net importer					
FX debt	0.0857***	0.0823***	0.126***	0.126***	0.234***
	[0.00619]	[0.00642]	[0.00749]	[0.00722]	[0.00938]
HUF debt	-0.01***	0.00948***	0.0552***	-0.01***	0.0221***
	[0.00170]	[0.00301]	[0.00459]	[0.00208]	[0.00326]
no debt	-0.003**	0.00339	0.0403***	-0.0023	0.0306***
	[0.00152]	[0.00234]	[0.00370]	[0.00190]	[0.00318]
Non trader					
FX debt	0.0234***	0.0223***	0.0751***	0.0484***	0.173***
	[0.00216]	[0.00249]	[0.00419]	[0.00277]	[0.00493]
HUF debt	-0.01***	0.00167	0.0425***	-0.012***	0.0204***
	[0.00156]	[0.00194]	[0.00341]	[0.00194]	[0.00314]
no debt	-0.00195	0.000114	0.0363***	-0.000725	0.0316***
	[0.00138]	[0.00176]	[0.00319]	[0.00175]	[0.00305]
TFP	0.000820***	0.00128***	0.00184***	0.000744***	0.000696***
	[0.000158]	[0.000196]	[0.000238]	[0.000180]	[0.000199]
Leverage	0.0386***	-0.000416	-0.00138	0.0485***	0.0389***
	[0.00290]	[0.00285]	[0.00340]	[0.00323]	[0.00381]
Dummy: took out loan	yes	yes	yes	yes	yes
Foreign dummy	yes	yes	yes	yes	yes
Dummy: size	yes	yes	yes	yes	yes
Dummy: sector	yes	yes	yes	yes	yes
Dummy: year	yes	yes	yes	yes	yes
Observations	175,920	164,945	156,251	176,917	174,495
R-squared	0.132	0.082	0.064	0.142	0.171

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 16
Probability of taking CHF loan

Dep. Var.: $loan_{t+j}$	[1]	[2]	[3]	[4]	[5]
method		approach A		approach B	
t	2007	2007	2007	2008	2009
t+j	2008	2009	2010	2009	2010
Net exporters					
FX debt	0.246***	0.0992***	0.0145***	0.218***	0.0336***
	[0.0108]	[0.00854]	[0.00373]	[0.00995]	[0.00421]
HUF debt	0.00572*	0.0470***	-0.000589	0.00778**	0.00191
	[0.00328]	[0.00635]	[0.00174]	[0.00340]	[0.00168]
no debt	0.0228***	0.0215***	-0.000823	0.0200***	0.0011
	[0.00305]	[0.00430]	[0.00137]	[0.00320]	[0.00143]
Net importer					
FX debt	0.343***	0.116***	0.0211***	0.280***	0.0490***
	[0.00984]	[0.00771]	[0.00369]	[0.00929]	[0.00464]
HUF debt	0.00292	0.0514***	0.00124	0.00538	0.000651
	[0.00322]	[0.00522]	[0.00174]	[0.00334]	[0.00149]
no debt	0.0223***	0.0261***	0.000207	0.0182***	0.000487
	[0.00306]	[0.00408]	[0.00143]	[0.00317]	[0.00140]
Non trader					
FX debt	0.397***	0.107***	0.0176***	0.338***	0.0528***
	[0.00532]	[0.00461]	[0.00189]	[0.00535]	[0.00266]
HUF debt	-0.0066**	0.0477***	0.00231*	-0.00235	0.000981
	[0.00304]	[0.00361]	[0.00132]	[0.00314]	[0.00142]
no debt	0.0215***	0.0240***	0.000795	0.0180***	0.00044
	[0.00285]	[0.00331]	[0.00121]	[0.00298]	[0.00132]
TFP	-0.000331	0.00275***	0.000408***	-8.20E-05	-7.92E-05
	[0.000269]	[0.000298]	[0.000133]	[0.000256]	[0.000110]
Leverage	0.117***	-0.0106**	-3.38E-05	0.0873***	-0.00316
	[0.00514]	[0.00431]	[0.00193]	[0.00476]	[0.00210]
Dummy: took out loan	yes	yes	yes	yes	yes
Foreign dummy	yes	yes	yes	yes	yes
Dummy: size	yes	yes	yes	yes	yes
Dummy: sector	yes	yes	yes	yes	yes
Dummy: year	yes	yes	yes	yes	yes
Observations	175,920	164,945	156,251	176,917	174,495
R-squared	0.373	0.065	0.016	0.304	0.044

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

MNB Working Papers 2012/8

Currency mismatch and the sub-prime crisis: firm-level stylised facts from Hungary